Electrical World

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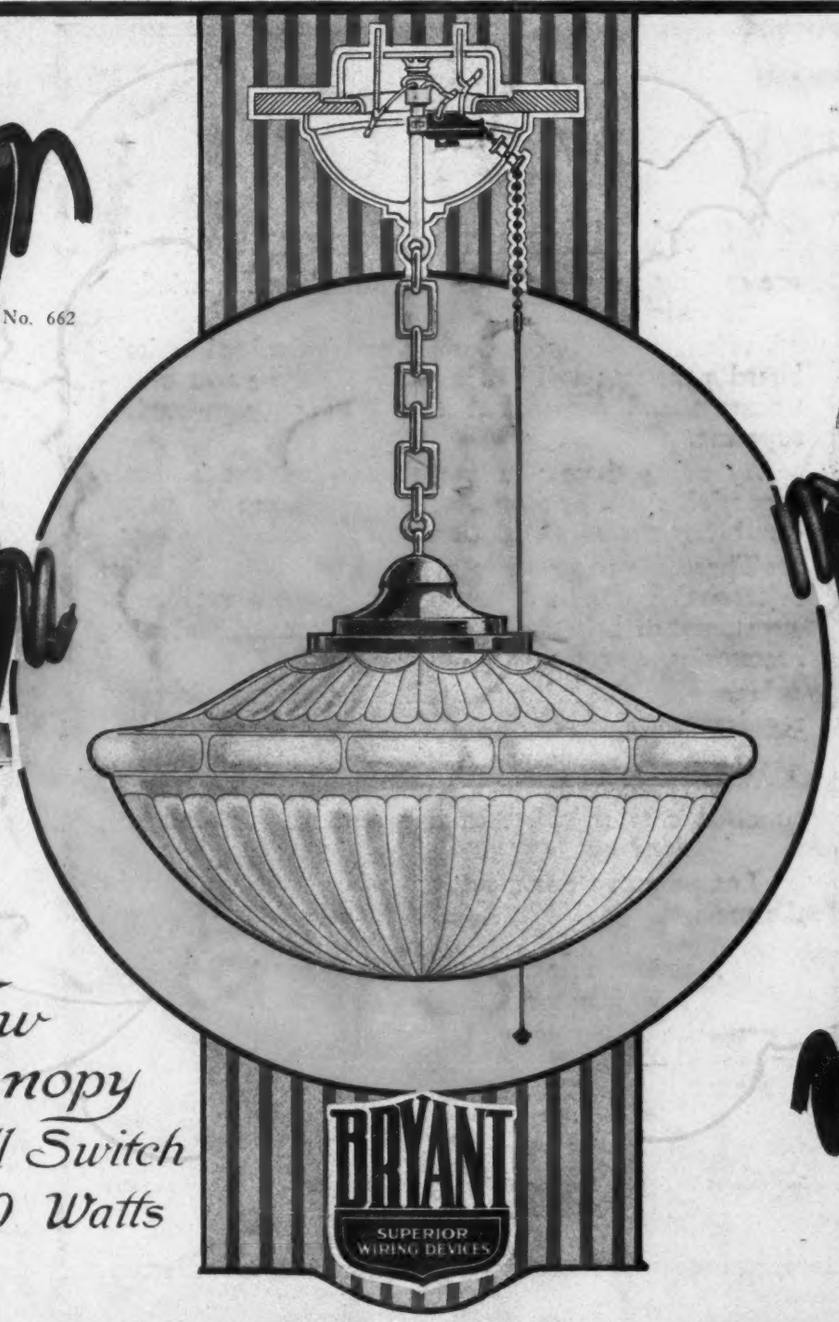

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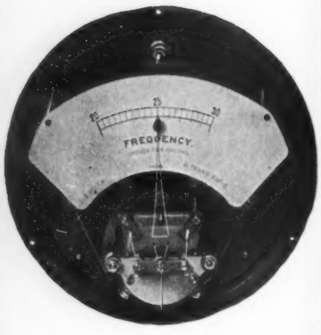

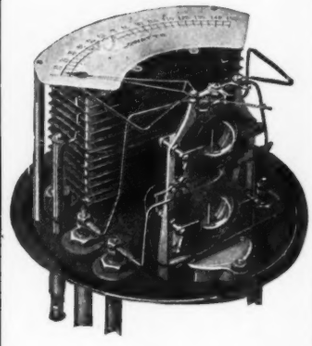

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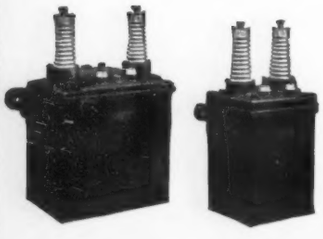

Electrical World

New York, Saturday, August 20, 1921

The Kind of an Electrical World That You Need

WE ARE young in the world of electricity. The electrical industry is growing. Conditions are changing. Relations are altering. There is always a lot to learn.

We are edging into a commercial era—all of us—the scientist, the inventor, the engineer, the business man. True, dreams and discoveries—more and bigger ones—are needed as we grow. Inventions must be multiplied year after year. The engineer finds broader and more complex problems in his path and meets them with greater achievements. But it is to the man of finance and the man of business as well that the industry is looking today. For only by better organization, better management and better selling can we expect to expand the greater market and bring a more complete electric service into every home, office, store and factory.

Look back through the pages of the ELECTRICAL WORLD and you find the story of the evolution of the electrical industry. As the industry has slowly changed, so has the ELECTRICAL WORLD, because it reflects and interprets accurately and in detail the happenings, the thinking and the record of the electrical industry. First, the progress in science and invention was recorded. Then, engineering as it became the dominating force in that industry was the major theme. Now is the heyday of the business side. Consequently the needs and the tendencies in load building, merchandising of appliances, new financing problems and the building of better and better public relations, together with the development of adequate marketing and distribution of electrical apparatus and conveniences, are important considerations from the standpoint of needed revenue to do more and larger things and make electric service sufficient to existing requirements. In brief, the electrical man today must pay as much attention to the business opportunities for expansion of the electrical industry as to the engineering aspects. As the industry expands into the larger commercial era that awaits it, there is a real need for more facts, more inspiration and more leadership.

Some readers want the ELECTRICAL WORLD to be strictly "their kind" of paper—fashioned to the inclination of their own thinking. But they should ask themselves, "What is the world of electricity today?" As the industry forges on, the world of electricity further evolves. Just as each of us is broadening to the changing times, the ELECTRICAL WORLD strives to reflect them truly. There is a lot yet to learn.

Le Roy Clark

An engineer and wire manufacturer under whose leadership the insulated wire and cable industry made an enviable war record

WAR requirements brought confusion to many an industry because of the tremendous volume of orders that came from every direction. No industry, however, was confronted with a task in war production more difficult than the one which confronted manufacturers of insulated wire and cable. None the less, this industry accomplished its task with the minimum of confusion and the maximum of efficiency under the leadership of Le Roy Clark, president of the Safety Insulated Wire & Cable Company, who was chief of the wire and cable section of the finished products division of the War Industries Board.

Before the war England had been recognized as one of the world's most prominent wire-producing nations. By 1917, when the United States became a combatant nation, England had found it impossible to produce enough wire to supply the war demands of herself and her allies. Consequently, American wire manufacturers were called upon to help, and so successful and reliable were they that on Oct. 1, 1918, the Allied Council reached the decision that beginning March 1, 1919, it would be necessary for the United States to furnish all the twisted-pair insulated wire used by the Allies in the field. The estimated minimum requirements for this purpose were 100,000 miles a month. As an indication of the confidence placed in the American manufacturers it is only necessary to point out that the braiding capacity of the United States on Sept. 1, 1918, was only 8,000 miles of this type of wire per month.

The wire industry, however, was able to accomplish big things because it was organized and led by a wire man of recognized standing and the highest integrity. In Mr. Clark's hands was placed the disposal of the entire insulated-wire production of the country. All government and Allied orders cleared through him, and he was always able to tell the production situation at all mills and was thereby enabled so to route this essential business as to guarantee maximum production speed.

Mr. Clark was born in New York City Feb. 16, 1872, and was graduated from the Columbia School of Mines in 1894. His entire business career has been with the Safety Insulated Wire & Cable Company, which he joined as an electrician a year prior to his graduation from college. Later he became electrical engineer for the company, and upon its reorganization in 1902 he was made vice-president. Four years later he became president. He has always paid the closest attention to the development of manufacturing processes and the bettering of wire quality. He has been active in perfecting paper-insulated wire.

His association work has been of considerable importance. He was first chairman of the Wire and Cable Section of the Associated Manufacturers of Electrical Supplies and was chairman of the electric wiring committee of the same organization which made the concentric wiring investigation. He is president of the Electrical Manufacturers' Club and is also a member of the A. I. E. E. and the Power Club.

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Shall the Electric Shop Render Service or Just Sell Electrical Merchandise?

EVERY now and then up comes the question, should the electric shop of the central-station company sell non-electrical merchandise? With it is coupled the suggestion that if this is done it calls attention to a serious weakness in electrical merchandise. But, after all, what difference does it make? The electric shop and electrical merchandise are young. The former is more limited in scope than it will be later on, for there is less variety in its electrical offerings than we shall see in years to come. Therefore, if the electric shop needs vital elements of "style" merchandise or low-priced goods to attract more customers of smaller means, why balk at it? The purpose of the shop is, first, to spread the electric service idea by increasing the use of electrical appliances and, second, to make money. Any proper merchandise that can be introduced harmoniously to promote these aims is therefore certainly justified. In times like these the sensible thing to do is to make the electric shop as successful and prosperous as possible. If mahogany table trays, tea sets, book rests and paper cutters provide a buying atmosphere and suggest the purchase of electrical appliances to the woman customer, or make her more satisfied with her electrical purchase, then by all means sell them to her.

Arbitrary Methods Shake Public Confidence

AS AN industry the electric light and power companies are gaining in public confidence. The good will of the public, however, is fickle to a large degree and may be lost quickly, particularly by companies which, thoughtlessly or otherwise, take unfair advantages. Recently two incidents occurred in a growing agricultural region that serve to illustrate what is meant. While the acts may not have been wholly wrong, they were decidedly unwise.

In one case a small utility went to the state public service commission for an informal discussion of an extension policy that obliged prospective customers to advance all money required to make extensions, no matter how small. A total expenditure of less than $40,000 was called for, a careful analysis of which revealed that less than $5,000 could be classified as representing extensions for which consumers could possibly be asked to advance the money, the remainder being for improvements not chargeable to individual consumers or groups of consumers. The other case involved the handling of money loaned by a small community to obtain electric service. The amount, though small, was sufficient to cause embarrassment to the small country banks if withdrawn too rapidly. In spite of an oral agreement to check out the money as needed over the construction period, it was withdrawn by one check a few days after the service contracts were signed, causing considerable embarrassment and a large amount of resentment.

Now, things like these simply shake public confidence, and when something really big and important comes up the public is afraid and distrustful.

Ford's Muscle Shoals Offer and Public Policy

MR. HENRY FORD'S offer for the government hydro-electric and nitrate plants at Muscle Shoals, Ala., is now receiving close scrutiny and analysis. Apparently the more the offer is studied the less attractive it becomes. It is of no concern to us, however, how much or how little Mr. Ford offers, bad as the showing is. It is enough to know that a private individual is seeking public property for private uses and individual gain. By and large, the water powers of the country belong to the public and should be developed for it either by the government itself or, preferably, by a governmentally controlled body like a public utility corporation. Then every cent expended and every cent earned come under the supervision of the state through its public service commission. Moreover, by this means the quality of the service and the rates to be charged therefor are also regulated. Thus control never passes from the public, which, while it gains through the initiative and enterprise of private capital expended for public use, merely pays in return a reasonable and publicly fixed rate on the money invested—no more.

On that account acceptance of any offer from Henry Ford is contrary to public policy so long as any public utility corporation or combination of utilities is willing to take over and operate the plants when they are completed by the government. Nor is Mr. Ford's offer in keeping with the spirit or letter of the federal water-power act of 1920. That measure provides for a fifty-year lease, whereas Mr. Ford seeks what is tantamount to a lease in perpetuity. If the government really wishes to dispose of its holdings at Muscle Shoals, we are confident it can quickly come to terms with public utility companies now in existence or hereafter to be formed. The value of the hydro-electric projects for public utility purposes can readily be fixed by competent engineers or, better still, by a public service commission which would use that valuation as a basis for service rates. Nothing could be simpler; nothing would more surely protect the investment of the War Department, and certainly nothing would commend itself more highly to the people of the Southern States, whose interest in the Tennessee River and the prosperity of the "old South" has lost none of its keenness. We have purposely refrained from referring to public utility companies because their interest is identical with the public interest, and, whether for weal or for woe, their fortunes are cast in the same die.

Where Reputation and Good Will Are Won or Lost

THE first step in building up good will toward the central-station company in any community should be the schooling of the employees truly to represent the company. This thought is brought out in the article by J. F. Owens in this issue in the relation of a bit of interesting experience. It is a point so self-evident that every manager might well be expected to keep it ever clear in mind but for the almost universal human failing that makes men overlook the simple, homely safeguard against hazards that in appearance are complex.

The public—meaning John and Mary and the rest of us—measure a business institution by a very fair and natural standard. They form their opinion of a utility corporation just as they form their opinion of a single person, by noticing the individual men and women who represent that company and by remembering what they say and what they do. If they see that the people in the company are courteous, just and efficient, they like the company; but if the employees are disobliging, selfish and negligent, they will not like that company, no matter how the printed advertising or the official spokesman may pour out the honeyed word.

The first duty of every utility executive therefore—the first duty not alone to the public but to the stockholders for whom he operates the company in trust—is to school his employees really to represent the spirit of the company. For it is the troubleman, the meter reader, the collector and the salesman that are being watched and remembered. It is they who build the reputation of the company and of the general manager as well, because the public rightly believes that these men mirror the attitude of the officials of the company.

Preventing Accidents from Oil Fires

HARNESSING the forces of nature for the use of man has gone on so rapidly that practices have sometimes been adopted in the absence of anything better which are unsatisfactory from the operating standpoint and often dangerous to life. The present use of oil as a cooling and insulating material in transformers and switches is a case in point. Oil is easily volatilized and when in that condition easily ignited. With the increase in the size of generating plants and with the resulting increased currents that must be handled it is being realized that something more than ordinary attention should be given switching and transformer equipment. When confronted with such a situation the first step the operating man will take will be to minimize the damage to surrounding equipment and the danger to human life by applying the best available methods for fire extinguishing.

The paper in this issue by C. T. Sinclair on "Combating Fires in Transformers and Oil Switches" is a good example of what a wise and able operator will do when facing the necessity of using operating equipment that he believes to be unsafe. However, further steps must be taken to meet the conditions of the future, the most important of these being the development of non-inflammable equipment for switching and transforming electrical energy. It must also be remembered that opening large currents means dissipating a very large amount of energy in a short interval of time. This alone may result in serious mechanical damage which in itself may be dangerous to life. Is not, therefore, the modern tendency, still opposed by many, of outdoor installation of transformers and switches the most constructive step toward improvement in operation? It certainly is the most efficient means of minimizing the danger to life and the possible damage to other equipment that we have so far developed. Beyond this, outdoor installations operate successfully against climatic disturbances and are nearly always justifiable from an economical viewpoint.

Keep Inductive Interference Out of Court

WHEN the inductive interference question came up for discussion by the sub-committee on public policy at the recent N. E. L. A. convention in Chicago there were some phases of the subject not completely covered in the interesting comments of R. H. Ballard and Bancroft Gherardi, and these phases need a little more attention before the program outlined can be successfully carried out. Unless cases now before courts or commissions can be settled without going to a formal decision, and unless litigation in other cases can be prevented, it is certain that these proceedings will, in some measure at least, embarrass the work of the joint committees, both state and national.

Such contests as that in the Homer case, recently decided in Illinois, can only produce sore feeling. An examination of the briefs in the case referred to reveals an attitude on the part of some of the attorneys that may be correct in an ordinary legal controversy but that will not lead to a state of feeling favorable to a real settlement of the matters at issue. It may be freely admitted that some of the men who took the stand did not possess an experience of years in the matters with which they were dealing. They were men who had won success in the fields in which they have worked—fields not totally unrelated to the matters at issue. In fact, the fundamentals with which they have had the greatest experience are the same as those underlying the problem of inductive interference. The attitude assumed by some of the attorneys in examining these witnesses may win a single battle, but it is the surest way to drive them and others concerned to a study that will give them an equal standing with any other men in dealing with this subject. The matters involved are not wrapt up in mysteries that research will not reveal. To make opponents the butt of arguments such as those set forth in detail in some of the Homer briefs is only begging the question and adding to its difficulties. Aspersions directed at men who have been successful in their work and bear national reputations are sure to provoke a bitter controversy that will end in a very unpleasant way.

Another inductive-interference case—this time in the East—has not reached the stage of publicity, but has already caused a feeling that the game is not being played entirely in accordance with the rules laid down in the Chicago discussion. This is apparently due to the presence of attorneys in the negotiations who cannot get away from the idea that the whole question is one of the legal rights of two contending parties and can be fought out in court with no regard for the public, since, in the attorneys' view, public rights are so

little involved as to permit ignoring them. The utility business has suffered and is yet suffering from the prevalence of similar notions in the early days of its history. It would be the height of folly to let the present situation drift along until the public takes an arbitrary hand because it can no longer tolerate the bickerings of men who are too short-sighted to see anything but their so-called legal rights. After all, these rights are determined by the necessities of the public as a whole, for no individual seeking personal aggrandizement in opposition to the public good ever "gets away with it" for long.

Intensive Training in Public Relations

MORE than eighteen months ago a "courtesy and good will" campaign was begun by the Edison Electric Illuminating Company of Boston to attain better team play among its employees and a closer service friendship between those employees and the public. The methods of the campaign were described on page 1157 of our May 21 issue, and readers of that article could not help realizing how groundless and outworn attacks on such a company as a "soulless corporation" have become in the light of its achievements in the field of public relations. "Noblesse oblige" has a very real meaning to the Boston Edison man and woman. The proof? It has lately been our privilege to read nearly 150 short essays submitted in a prize contest for the best paper on some aspect of public utility relations within the company, and with scarcely an exception every contestant has clearly acquired a viewpoint of such sanity and comprehension as to what constitutes courteous, friendly and loyal service that President Edgar and his associates are to be congratulated. Nearly 450 subordinate employees out of a total enrollment of about 2,000 entered the competition, and from coalpasser to office worker it was evident that the "goodwill and courtesy" idea had struck home. Though some of the essays could fairly be called homilies, they none the less expressed principles of conduct in mutual and public relations that might well be more widely practiced. Outside observation of the "approach" of employees and their attitude toward the public in multifarious contacts over the wire, in offices, by mail and among neighbors and strangers shows that as individuals these public utility men and women are striving to live up to the precepts of the campaign, and an extraordinary falling off in complaints received gives the final touch of success to an experiment of far more than local interest.

Simplification in a Converter Substation

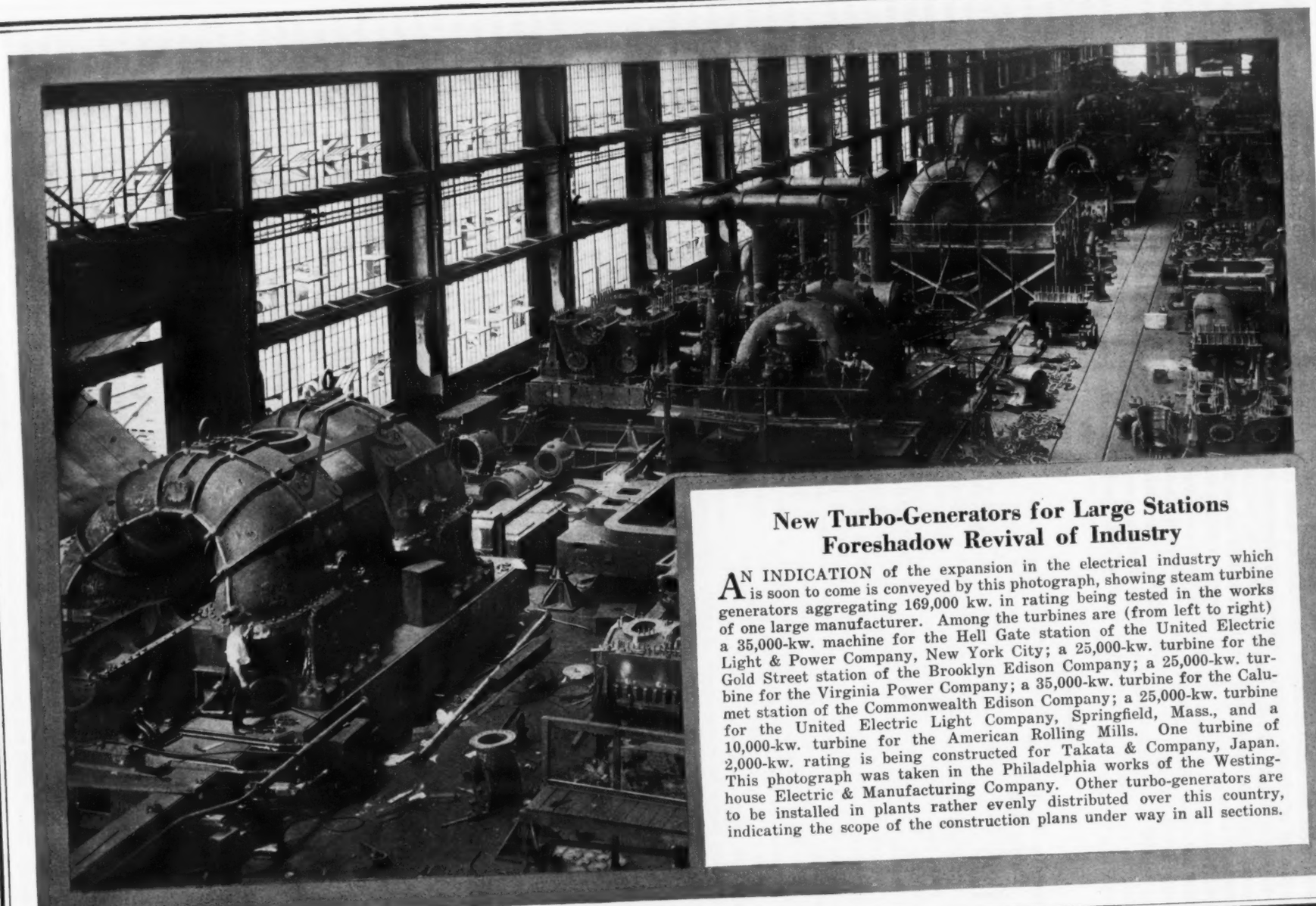
MODERN requirements have brought increasing use of converter substations in electric railway service, and incidentally enormous construction costs if conventional equipment is to be provided. For as time has gone on it has become customary to set one protective device to watch another, and a third to watch the pair, and an automatic contrivance to watch these, and remote-control oil switches to stand guard over the lot, and a special set of relays to protect the switches from "house-maid's knee," until the treasurer of the concern falls in a faint. There are signs, however, that more attention is now being directed toward such complications, with a decided drift toward simplification, or toward a perfectly definite automatic operation in which simplification of the things to be done is a necessary part. In the current issue J. E. Woodbridge gives a particularly instructive account of a new 4,000-kw. converting station in San Francisco in which simplicity and ease of operation have been the controlling features.

The losses in the railway system had risen to so formidable an amount that something had to be done, and the result was a compact and efficient converter station in the downtown district. Using converters so near to heavy load brings some risks from the absence of the damping effect of long feeders, but special precautions to guard machines and operators and a very slight use of resistors avoided the difficulty. One feature of the plant is the use of shunt-wound converters, which considerably diminished the danger from short circuits, reduced the heavy windings, eliminated equalizer connections and simplified operations generally. The slight additional drop in voltage has, in fact, proved somewhat advantageous practically.

A rather unusual feature of the installation is that the converters are on insulating bases, to lessen the blow from a flashover to frame or from windings to core. The main floor of the station also has an upper asphaltic layer that insures safety from high-tension contacts. The net result of the design adopted in this plant has been much simplification and highly efficient operation with but a single attendent per shift. Those who are contemplating the erection of converting substations will do well to give Mr. Woodbridge's article careful study.

Electric Service on the Western Ranch

WHILE the term ranch is still applied by the Western man to his rural homestead, the pursuits followed thereon frequently vary widely from the popular conception of bronco busting and cattle raising on a vast expanse of sagebrush. In the Pacific Coast and Northwest districts, where electric service lines and motor-driven pumps have created veritable gardens, an area of 40 acres is still rated as a ranch. In the San Joaquin Valley, for instance, where these small ranches abound, the public enjoys a real interpretation of electric service that would be a mighty asset to other sections as well. In that valley farmers or ranch owners are making advance applications for electric service connections and anxiously await station construction that will make these possible. Desert land now used for cattle raising and grain production at a value of $150 to $300 per acre will have a value of from $1,500 to $2,500 as soon as irrigation is made possible. Self-interest there is a powerful influence for electrial development, which is gaining the ear of the public service commissioner and the investor alike. But this same type of self-interest exists in other sections. The San Joaquin Light & Power Company has simply pointed the way to its application in the development of electric service elsewhere. Only fifteen years ago that company was a struggling concern with just enough generating capacity to take care of the limited needs of a few small communities and with a gross income of $125,000. Today it serves a great fertile valley and has a return of $4,500,000 annually, built largely upon the good will of the rural public it serves.



New Turbo-Generators for Large Stations Foreshadow Revival of Industry

AN INDICATION of the expansion in the electrical industry which is soon to come is conveyed by this photograph, showing steam turbine generators aggregating 169,000 kw. in rating being tested in the works of one large manufacturer. Among the turbines are (from left to right) a 35,000-kw. machine for the Hell Gate station of the United Electric Light & Power Company, New York City; a 25,000-kw. turbine for the Gold Street station of the Brooklyn Edison Company; a 25,000-kw. turbine for the Virginia Power Company; a 35,000-kw. turbine for the Calumet station of the Commonwealth Edison Company; a 25,000-kw. turbine for the United Electric Light Company, Springfield, Mass., and a 10,000-kw. turbine for the American Rolling Mills. One turbine of 2,000-kw. rating is being constructed for Takata & Company, Japan. This photograph was taken in the Philadelphia works of the Westinghouse Electric & Manufacturing Company. Other turbo-generators are to be installed in plants rather evenly distributed over this country, indicating the scope of the construction plans under way in all sections.

Combating Fires in Transformers and Oil Switches

Use of Carbon Tetrachloride, Bicarbonate of Soda and Sulphuric Acid, Foamite, Water, Sand and Wet Sawdust Studied with View Toward Determining Effectiveness and Protecting Personnel

By C. T. SINCLAIR
Assistant Testing Engineer Pennsylvania Water & Power Company

TRANSFORMER oils are required to perform the twofold function of insulating and cooling. To perform its function as an insulator properly it is necessary that the oil should have a high dielectric strength; to perform its function of cooling properly it should not be too viscous. However, oils of low viscosity have correspondingly low flash points, which means considerable fire risk. A heavier oil, with a correspondingly higher flash point, cannot readily be used owing to the fact that at lower temperatures it becomes extremely thick, in consequence of which its efficiency as a cooling medium is impaired.

On the other hand, in oil switches, oils of somewhat higher viscosity may be used, because here the property of cooling is relatively unimportant. However, selection of the oil is again limited by low temperature conditions, for it is obvious that an extremely viscous oil would be rather unsatisfactory for extinguishing the arc. The flash points of almost all of the transformer and oil-switch oils used are under 190 deg. Therefore there is considerable fire risk. Fortunately, transformer and oil-switch fires are comparatively rare, but in event of one starting they are difficult to extinguish by untrained men. A small amount of training of the operating personnel will render them fairly efficient in combating the majority of electric station fires. In consideration of these facts the Pennsylvania Water & Power Company made an investigation of the methods of extinguishing these fires, with the object of increasing the efficiency of operation and protecting its personnel and equipment.

MOST SUITABLE FIRE EXTINGUISHER DEPENDS ON CONDITIONS

The results of the investigation showed that for transformer fires the "soda" extinguisher is very satisfactory and no new equipment has to be purchased. It would only be necessary to run two short pipes to opposite ends of each transformer and in case of fire insert the nozzles of the extinguishers in the ends of the pipes. The transformer should be electrically dead before the soda is applied.

In the case of low-tension oil switches, if the fire is in the tops of the pots only, carbon tetrachloride may be used to extinguish it. If this fails it is necessary to render all parts of the switch electrically dead. Sand can be used successfully to extinguish any blaze in the bottom of the compartment, and then carbon tetrachloride will usually be effective in the tops of the pots. If this should be ineffective after considerable effort "soda" may be used, but this necessitates the "killing" of all apparatus within reach of the stream from the tank. The maximum length of the stream is about 30 ft.

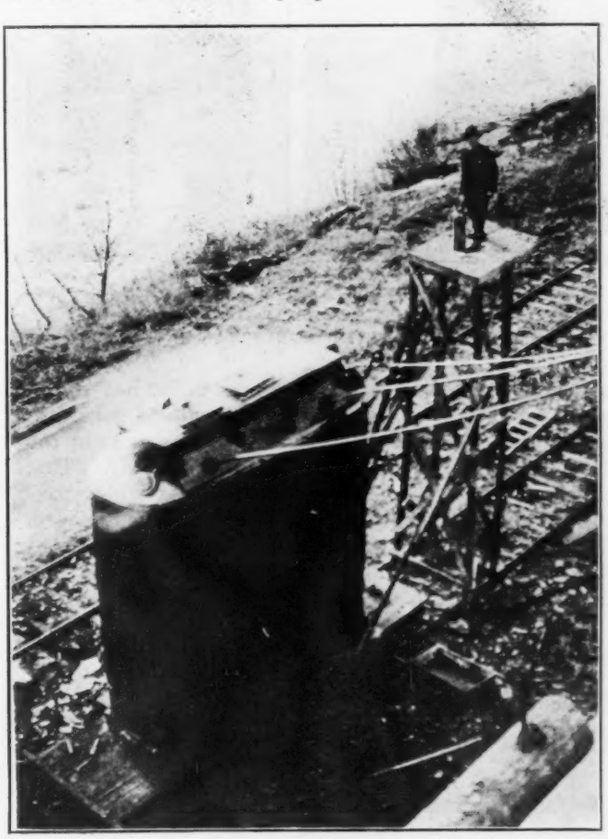


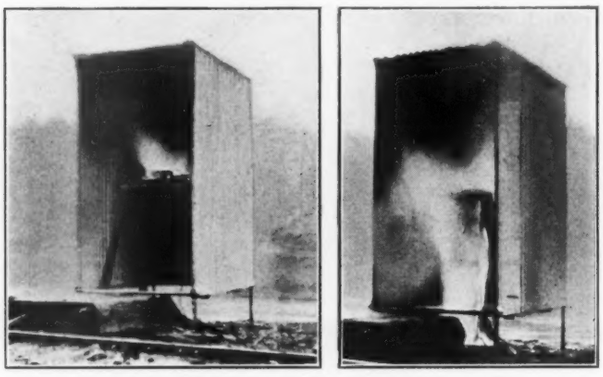
FIG. 1—TRANSFORMER WITH PIPE CONNECTIONS FOR INTRODUCING LIQUID EXTINGUISHERS AND ELEVATED PLATFORM FOR APPLYING EXTERNAL EXTINGUISHERS

In event of a high-tension oil-switch fire carbon tetrachloride should be used if possible. If this fails it will be necessary to use soda, killing as much apparatus as necessary to give the operator protection, which may mean as much as half of the station.

PERSONNEL MUST BE WARNED OF HAZARDS

It is very evident that in combating fires that occur in electric stations special training should be given to the operating force. In this company instructions similar to the suggestions mentioned are issued. Furthermore, members of the operating force are given the opportunity to witness demonstrations by experienced men in fighting fires and are required to extinguish fires themselves under supervision. The fact is impressed upon them that it is usually desirable to start at the base of an oil-switch fire and work upward. The equipment shown in Fig. 2 to 5 is used for this purpose.

The tests made recently of the rupturing capacity of various types of oil switches have shed some light on the fighting of oil-switch fires. It had formerly been assumed that a considerable portion of the oil was heated above the burning point at the time the switch opened owing to the arc, thus igniting the oil. The tests mentioned showed that this is not necessarily the case. The temperature rise of the oil in the pots may not be more than a few degrees Centigrade and still the oil



FIGS. 2 AND 3—AN 11-KV. OIL SWITCH MOUNTED IN COMPARTMENT FOR TEST, SHOWING FIRE IN TOP OF POT AT LEFT AND VIOLENT EXTERNAL BLAZE ON RIGHT

may catch fire. When a switch opens under heavy load the arc produced vaporizes some of the oil and generates considerable pressure, which in turn forces some of the oil out through various openings in a spray. This "atomized" oil is ignited by the hot gases which pass out at the same time, causing in some cases long sheets of flame. Recent oil-switch designs are tending toward reducing this "atomizing" action by the use of baffling devices of one form or another, which permit the gas to escape, but not the oil.

Details of some of the tests made by the Pennsylvania Water & Power Company to determine the best methods of combating transformer and oil-switch fires follow:

FOUR METHODS OF FIGHTING TRANSFORMER FIRES STUDIED

To facilitate conducting the transformer tests a shell, shown in Fig. 1, was prepared with a false bottom to reduce the quantity of oil required in the test. The oil was heated to the desired temperature by grid resistances. Four general methods were employed in extinguishing transformer fires, namely: (1) Carbon tetrachloride; (2) bicarbonate of soda and sulphuric acid (referred to as "soda")—a carbon dioxide and water extinguisher; (3) water; (4) Foamite, a form of carbon dioxide extinguisher.

In applying carbon tetrachloride it is necessary that a jet of the liquid impinge on a surface above the fire, in order that the liquid may be converted to a gaseous state, thus "blanketing" the fire and cutting off the supply of air. In order to obtain this condition a perforated pipe was run around the interior of the transformer just over the oil surface so that liquid admitted to the pipe would pass through the perforations and impinge on the opposite side of the interior of the transformer, thus forming a gaseous blanket over the oil surface. The oil was heated well above its burning point (varying from 160 deg. to 210 deg. C. on the various tests) and ignited, with one lid off to provide sufficient air for burning. The oil was permitted to burn for about five minutes, and carbon tetrachloride was admitted at a pressure of about 50 lb. per square inch. This extinguished the fire in ten seconds, using four gallons of the liquid. Considerable smoke and some increase in flame resulted from this application. This test was repeated several times, with similar results.

Soda was tried next. Two pipes were run from a somewhat elevated point to the opposite ends of the transformer, the ends of the pipes discharging directly onto the oil surface. The oil was ignited and permitted to burn as usual. Two standard "Underwriters" soda tanks (2½ gal.) were used, the nozzles being inserted in the ends of the two pipes leading to the transformer. After the fire had been burning for five minutes the tanks were inverted so that the carbon dioxide gas and water ran down the pipes into the transformer and extinguished the fire. Several tests showed that about eight seconds was required for the two tanks to extinguish the fire. If only one tank is used about twelve seconds is required. Only a slight increase in the volume of flame and smoke was noted when the soda was applied.

In applying water the perforated pipe used in the carbon tetrachloride tests was employed. Considerable flame, perhaps 20 ft. in length, was emitted with quantities of smoke and steam, and some oil was even thrown out of some of the openings. The fire was, however, extinguished.

Foamite, the trade name for a fire extinguisher somewhat similar in its action to the soda extinguisher, was next tried. The stream of this extinguisher was played directly on the burning oil surface. One tank extinguished the fire in fifteen to twenty seconds.

While the oil switches* used by the Pennsylvania Water & Power Company are very similar so far as their operating mechanism is concerned, their construction is so different that the same method of combating fires cannot always be used. To study what methods

FIGS. 4 AND 5—A 70-KV. OIL SWITCH IN TEST COMPARTMENT SHOWING FIRE IN TOP OF POT AT LEFT AND EXTERNAL FIRE ON RIGHT

are best two compartments were constructed of sheet iron and pots mounted therein, the dimensions being the same as the dimensions of the 11-kv. and 70-kv. oil switch compartments (one phase only of each). Fig. 2 shows the 11-kv. compartment with the oil-switch pots in place, and Fig. 4 shows the 70-kv. compartment containing the pots. Electric heaters were used to raise the

*General Electric type H3, rated at 11 kv. and 70 kv.

oil in the pots (about 3½ gal. instead of the usual 2 gal.) to a fairly high temperature (about 300 deg. C.).

The low-tension switch was tested first. A quantity of wood was thrown in the bottom of the compartment, saturated with oil and ignited in order to render the condition more severe. A 2½-gal. tank of Foamite was used in extinguishing the fire. Similar fires were extinguished with tanks of "soda." Small fires localized in the tops of the pots were extinguished with carbon tetrachloride, which is entirely ineffective when applied to larger fires.

To test the efficacy of damp sawdust as a fire extinguisher a fire was built in and around the pots. Despite the violence of the fire produced (Fig. 3) it was successfully extinguished by the sawdust, thrown from a bucket. While this was being done a small quantity of the damp sawdust fell into the blazing pots. A miniature explosion took place, throwing blazing oil in all directions. This fire was extinguished by the application of more sawdust at the base of the switch and by the use of carbon tetrachloride to combat the small blaze in the pots. Sand may be substituted for sawdust, for it is equally effective.

Fires in the high-tension oil pots (Fig. 4) were extinguished with carbon tetrachloride, the temperature of the oil being 300 + deg. C. Next a small wood fire was built under the pots (Fig. 5) and permitted to burn for about five minutes, igniting the oil in the pots and making a violent fire. Application of Foamite extinguished the fire in about fifteen seconds. Two fires similar to this, but perhaps more violent, were built and successively extinguished by the use of "soda." Due to the design of this switch, which had an open base, sawdust and sand could not be used.

A number of open-wood fires were built and the different extinguishers tried on them. The Foamite and "soda" are both extremely effective on fires of this type, with a slight advantage in favor of the Foamite, as the thick foam generated adheres to the wood and prevents reignition.

Precautions in Using Different Extinguishers

While it was known that both "soda" and Foamite fluids were conductors, tests were made to determine whether or not the jet issuing from the nozzle is a conductor. The tests were made with a megger and with voltages up to 80,000 volts. It was found that a "soda" jet was an insulator beyond about 44 in. from the nozzle, due to the drop form in the jet at this distance, but a few inches nearer it became a fairly good conductor on account of the solid stream of liquid near the extinguisher. Either liquid, if permitted to run over an insulator, will cause a flashover. Carbon tetrachloride is an excellent insulator.

Some precautions are necessary in applying these types of extinguishers to fires. In using "soda" or Foamite the apparatus should be electrically "dead," first, on account of the danger of a flashover, and, second, on account of the danger of the operator getting too near and permitting the jet to conduct the current to his body. In applying sand and damp sawdust the same rule applies; furthermore, great care should be taken that none of this sand or sawdust falls in the blazing oil pots, as the operator may be severely burned and the intensity of the fire increased.

It is particularly desired to call attention to the danger to life of employing the most widely used fire extinguisher—that embodying carbon tetrachloride—in small, poorly ventilated locations. After a number of deaths had occurred while using this extinguisher, the Bureau of Mines made an investigation and determined that under certain conditions the most deadly gases are generated often in toxic quantities, such as phosgene, chlorine, hydrogen chloride, carbon tetrachloride and chloroform (arranged here in order of their toxicity). It is not believed that the use of this liquid should be discontinued for electrical fires because it is often valuable in extinguishing small fires. However, it is believed that care should be taken in its use. It should not be used in a confined space unless an army gas mask or other suitable protection is used. The mere knowledge of the fact that dangerous gases result from its use renders it comparatively safe, as the operator will not remain in the presence of its fumes.

Electrification Program of Czechoslovakia

A Maximum Hydro-Electric Output of 355,500 Kw. in Bohemia, 200,000 Kw. in Slovakia and 59,000 Kw. in Moravia

By Prof. Fernando Pietsch
Professor of Electrical Engineering in Prague

TO THE best of the author's knowledge, this article is the first to give American readers a detailed account of the present and the planned developments of electric power supply in the new Czechoslovak republic.

As far as a geological survey could ascertain, the republic has within its boundaries total resources of anthracite, bituminous and lower-grade coal amounting to about 140,000,000,000 tons. According to official statistics for the year 1920, the coal production was: Anthracite (74,780 miners), 5,565,000 tons coal, 700,000 tons coke and 722,000 briquettes; bituminous (51,718 miners), 9,800,000 tons coal.

There were 272.76 working days in the year, or an average of 5.24 days per week. The average daily output per man and shift was 556 lb. anthracite and 1,355 lb. bituminous. The average yearly output per man was 148,800 lb. anthracite and 380,800 lb. bituminous. It is expected that this production will be increased considerably as soon as social conditions become more settled. From hydro-electric power plants the following energy is either already available or will soon be developed:

River	Method	Maximum Output, Kw.	Yearly Production, Kw.-Hr.
In Bohemia:			
Elbe to Königrätz	Dam	4,000	17,000,000
Elbe to Melnik	Canal	16,000	87,000,000
Elbe beyond Melnik	Canal	11,000	92,000,000
Tributaries to the Elbe	Dam	18,000	76,000,000
Moldau to Budweis	Canal	39,000	156,000,000
Moldau to Prague	Canal	87,000	450,000,000
Moldau to Melnik	Canal	12,500	106,000,000
Tributaries to the Moldau	Dam	168,000	674,000,000
Total		355,500	1,658,000,000
In Moravia:			
Total		59,000	178,000,000
In Slovakia:			
Total		200,000	.....

This gives a total of more than 500,000 kw. for the entire republic. Statistics of 1919 showed 390 power plants in the republic, of which there were six rated

at more than 10,000 kw., three of from 5,000 kw. to 10,000 kw. and twenty-eight of from 1,000 kw. to 5,000 kw.

The largest of these plants is in Prague, the capital of the republic, with 22,300 kw. normal output. Virtually all of these plants operate on three-phase, 50-cycle current with transmission voltages of 3,000, 22,000 and 35,000. One system, operated by the Skoda works at the mouth of a mine, transmits power to Pilsen at 100,000 volts.

During the year in which the war began (1914) the Bohemian power plants sold a total of 160,000,000 kw.-hr. Before the war a number of power-plant associations were formed for the supply of certain rural areas. These existing companies, with several formed later, are now being used for the general electrification of the republic, and it is intended to combine them ultimately by one great merger. Six similar local enterprises are planned for Moravia.

In the meantime the new electrification law, which passed on July 22, 1919, provides for a general and systematic power supply of the entire republic. A first appropriation of 75,000,000 crowns has been made and will be used for the enlargement of hydro-electric plants and the assistance of such associations as will be a part of the new system. Financial participation of counties and joint-stock companies in this public service system has been limited to a maximum of 25 per cent. All plants which will participate in the general electrification plan have been classified as public utilities and will enjoy certain rights, as for example, the right of expropriation.

PLAN OF CONSULTING BOARD

Of great importance is the establishment of a consulting board for the entire system, consisting of representatives of industry, agriculture, science, labor and consumers of energy. All plans for new developments have to be presented to this board for approval. This board has established a number of standards for the systematic carrying out of the work, the most important of which are:

1. Steam power plants should be erected only on a large scale and, if possible, near mines, so as to obtain as high efficiency as possible.

2. Hydro-electric plants should be operated to maximum economy along the whole river and should be built with a view to co-operation with other nearby plants.

3. All transmission lines should be so built as to form a uniform network.

4. All energy generated should be three-phase at 50 cycles. Railway power stations and enterprises which can prove that such energy will not fill their requirements are excepted.

5. For the standard feeder voltage 22,000 volts has been decided upon, except for nearby power supply, for which the direct generator voltage is sufficient.

6. For the standard trunk-line voltage 100,000 volts has been chosen with the permission to use temporarily 50,000 volts.

7. The consumers' voltage should be 220-380 volts. For private enterprises 500 volts with grounded neutral is permissible. In direct-current distribution systems 440 volts with grounded neutral should be provided.

8. As standard generator voltage 6,000 volts has been established.

The goal of the whole program is to supply all needed electrical and mechanical energy from this systematized network, into which nine large steam power plants will feed. Besides these, all hydro-electric plants which operate by means of water storage are to be tied in and to cover all peak loads, in order to save coal. Assuming this hydro-electric energy to amount to 500,000 kw., a yearly saving of about 6,000,000 tons of coal will result. For all new steam-power plants gasification of the coal on a large scale is recommended, so as to obtain all the valuable by-products such as tar, ammonia, ammonium-sulphate, etc.

The cost of the new steam-power stations, the trunk lines and the feeder lines is estimated at about 1,500,000,000 crowns. These stations and the network should be completed in twenty years and the hydro-electric development in fifty years. The state will build all the water-power plants in co-operation with the county administrations. The steam plants should be erected by public utilities with state aid.

The use of electrical energy could be increased very materially by electrifying the principal railroads, but present conditions are not promising for this, and it is found far more profitable to sell the energy for industrial purposes. The railroad department is, however, investigating a main-road electrification within 50 km. of Prague which would relieve the present very congested conditions.

Baden Government Plans Extensive Hydro-Electric Development

THE German state of Baden has, according to a correspondent of the ELECTRICAL WORLD, just passed a law for the purpose of supplying electrical energy all over the country by means of a state-owned company. The nominal capital of this company is fixed at 30,000,000 marks, but it has in addition been authorized to raise a public load to the amount of 500,000,000 marks which will be fully guaranteed by the state. All electric plants owned and operated by the state, such as the important Murg power works, become the property of the new company. The existing power plants have not been nearly able to supply the increasing demand for energy. At the present time 500,000 tons of coal are required annually for the generation of power and light, corresponding to an output of 500,000,000 kw.-hr. This it is now proposed to produce by development of water power.

In the south of the country, on the line from Basle to the Lake of Constance, a number of hydro-electric power stations will be erected. One of the largest power plants will be constructed at Schwörstadt, on the German-Swiss frontier, and in this plant Switzerland will be interested financially as well as industrially, as the latter country will receive half the amount of energy produced by this station, namely, 189,000,000 kw.-hr. The total cost of this power station is estimated at 320,000,000 marks. In order to be able fully to utilize the Rhine power works, a great storage lake will be constructed in the southern part of the Black Forest with a capacity of 72,000,000 cu.m. Several subordinate companies, all controlled by the state, will be formed to carry out this part of the work. Similar steps have been taken for the electrification of the central and northern parts of Baden. The Murg power station is to have a large storage lake, to be created by means of a powerful dam across the surrounding valley, at a cost of 200,000,000 marks.

Simplified Layout of Rotary-Converter Substation

Shunt-Wound Machines Allow Operation of Feeders Only 250 Feet Long—Quick Resumption of Service After an Interruption—Direct-Current Starting Switches and Unnecessary Meters Omitted

By J. E. WOODBRIDGE
Resident Engineer Ford, Bacon & Davis, San Francisco, Cal.

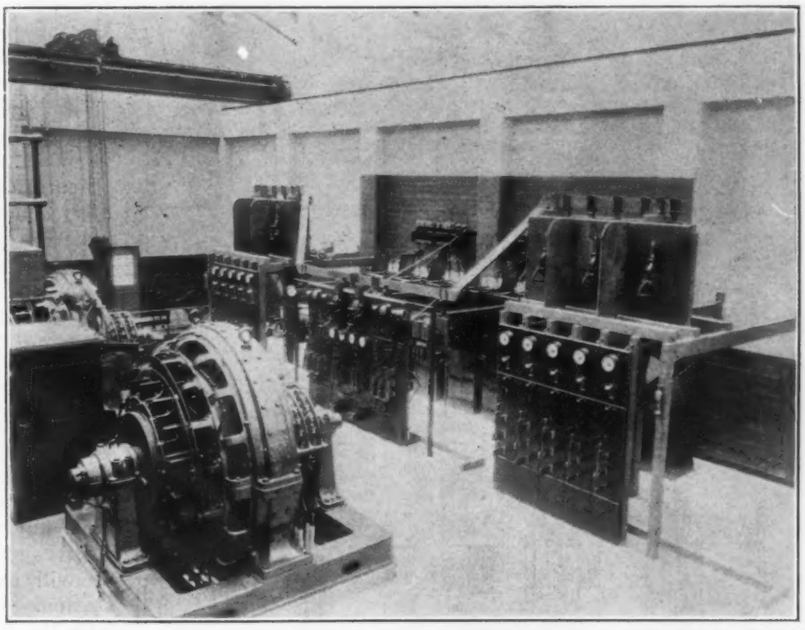
AS IN most large cities, the substations and 600-volt feeder system of the United Railroads of San Francisco grew out of old steam plants poorly located for supplying the most congested portion of the load. As a result a large energy loss was present at times of heavy load in feeders and track circuits. It was to overcome this long-distance distribution and to take care of an increasing traffic that a 4,000-kw. rotary-converter station (ultimate rating 10,000 kw.) was designed and completed two months ago. Some special problems, such as very short feeder length, were solved in the design, which also includes novel and effective arrangements of machines, switches and circuits.

The downtown district of San Francisco, including the heavy traffic of four tracks on lower Market Street, was until recently supplied largely from the Bryant Street substation (originally a steam plant) situated about 20,000 ft. (6,000 m.) from the ferry. In spite of a large tonnage of feeders, the voltage drop during the peak hour from 5 p.m. to 6 p.m. would run as high as 250 volts, giving a loss of approximately 2,000 kw. wasted in heating overhead copper and track return. The United Railroads of San Francisco bought energy under a contract rate of $7.50 per 1,000 kw.-hr. at 11,000 volts, with a guaranteed load factor of 60 per cent. As this load factor is not reached, the basis of the contract becomes power and not energy, the price being approximately $40 per kilowatt of peak demand per annum.

As 2,000 kw. of loss amounts at this rate to $80,000 per annum, it is obviously worth while to give careful consideration to any means by which this loss can be materially reduced. Moreover, in spite of municipal competition, the traffic of the United Railroads of San Francisco (now the Market Street Railway Company) has been steadily growing, increasing the load on stations and feeders to the value reached during the Panama Pacific Exposition and requiring extensions to take care of future growth.

The writer estimated that the installation of a 4,000-kw. substation, suitably located in the downtown district, would reduce the feeder losses, and thereby the peak demand, by approximately 1,200 kw., besides releasing a large amount of copper. Such a substation has been built, and although it has been in full operation less than two months, which is not a sufficient period to give an accurate comparison of new with old system peak demands, there is every indication that the estimated saving will be exceeded.

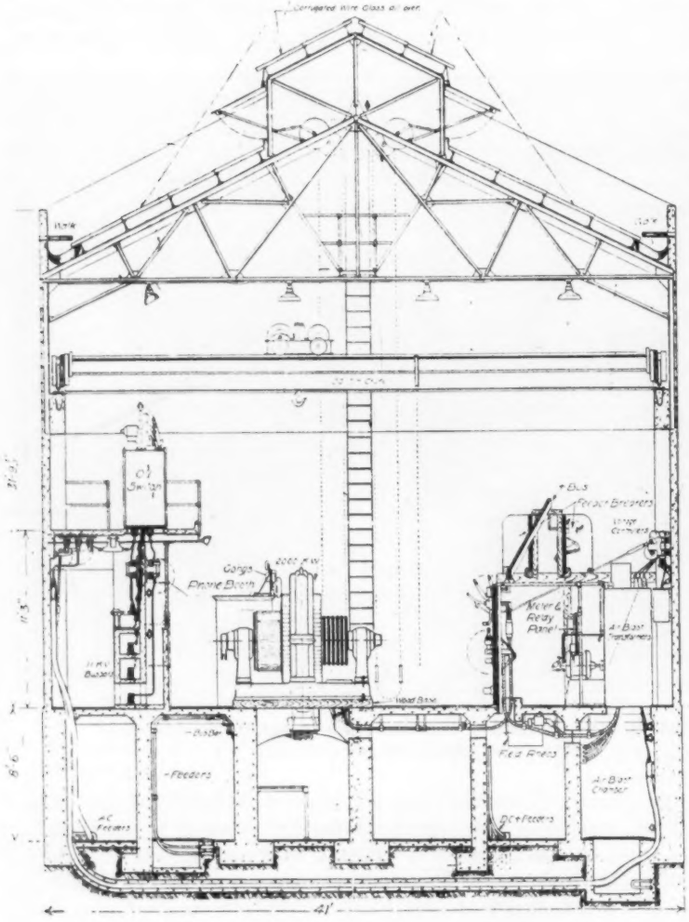
On account of lower first cost and higher efficiency, converters were chosen for this service instead of motor-generator sets such as were used in the older stations. The use of converters so close to heavy traction loads involves several serious difficulties due to the absence of direct-current feeder resistance to reduce the rush of short-circuit current in case of a broken trolley, car-equipment failure or other fault from feeder network to ground. The old specification of no feeder taps nearer than 2,500 ft. to the station is not applicable where the heaviest load is 250 ft. away, and 2,500 ft. is about as far as the station feeds. The manufacturers' specification of sufficient feeder resistance to limit the short-circuit current of one feeder to three times full load of one machine is also not applicable where one feeder has a peak-hour average demand of 3,000 amp., which is approximately the rating of one converter. This would require a 30 per cent drop in this feeder or about a 500-kw. loss at $40 per kilowatt per



DISCONNECTING SWITCHES FOR OIL CIRCUIT BREAKERS ARE IN CONVENIENT REACH ON MAIN FLOORS

annum. Precautions of various sorts, described further on, were taken to protect the machines, operators and circuit breakers, and the minimum resistance to any one point on the trolley network was made 0.025 ohm, which would obviously limit the current to 20,000 amp. at 500 volts. This resistance was obtained in most cases by bringing the feeders out from underground to overhead as near the substation as possible and running the rest of the distance in weatherproof cable at a higher current density than can be used underground without danger of burn-outs. Added resistance was necessary in only two feeders, involving a loss of approximately 10 kw. in each at the peak. One of these resistors is used as an electric furnace with air taken from the air-blast chamber to warm the office.

The converter fields are shunt-wound, this departure from standard railroad practice having been taken for several reasons, as follows: First, to ease the severity of short circuits; second, to reduce the number of heavy windings and large joints in the machines; third, to eliminate the equalizer busbar, switches and connections and to simplify operation; fourth, to improve the power factor on the assumption that the equipment will be loaded to its capacity on the basis of temperature rise, in which case improved power factor is a decided advantage. The commutating poles are of the high-reluctance design, their ampere-turns being greater than those of the armature.



CROSS-SECTION OF 4,000-KW. ROTARY-CONVERTER SUBSTATION EQUIPMENT IS ARRANGED FOR SAFETY AND FOR QUICK RESUMPTION OF OPERATION AFTER A "KNOCKOUT"

A somewhat unexpected advantage has resulted from the shunt characteristic. As the station output rises in the late afternoon from approximately 6,000 amp. to 9,000 amp., the voltage automatically falls off from 550 to 500. As the peak is occasioned by congestion of cars on the downtown streets, which of itself necessitates running slowly, the lower voltage undoubtedly results in less resistance loss in car equipments and in improved system economy. The voltage drop is, however, so much less than with the old long feeds that better schedules are maintained, and a car will probably be dropped from each of several routes without increase of headway.

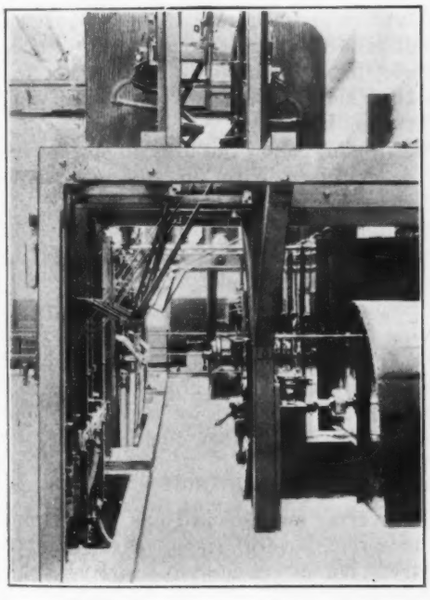
The equipment is designed to make it possible to alter the voltage under load conditions without power-factor variation. This is accomplished by taps in the primary windings of the step-down transformers, these taps being brought out to step-by-step circuit-breaking contactors, manually operated, with auto-preventive reactors for maintaining the connections while stepping from tap to tap. The transformer ratio is changed 1.5 per cent per each of eight steps, giving a total ratio range of 12 per cent. The transformer primaries are star-connected, and the taps for this purpose are brought out at the neutral end of each primary, giving minimum voltage between the taps of the three phases and from contactors to ground. The transformers are of the air-blast type, and all taps for this purpose are brought out through the tops of the transformers to controllers installed immediately above them, giving a location in plain view and convenient of access for these devices "isolated by elevation." The transformers are installed behind the main switchboard, and the voltage control is actuated by means of mechanical shafting from hand cranks on the face of the board.

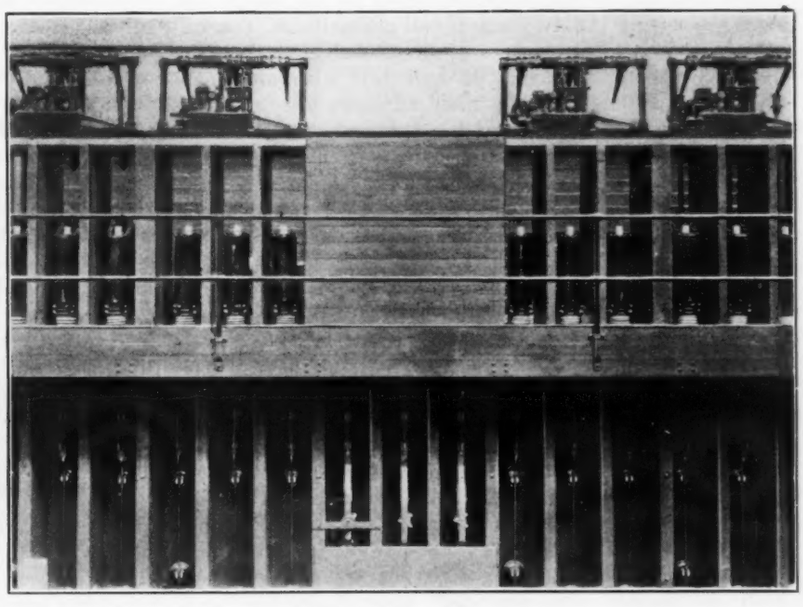
Voltage control was considered desirable in this case because of the convenience of such control in the motor-generator stations of the same system and the inconvenience of the fixed voltage of converters as ordinarily equipped. One of the chief advantages of voltage control is the ability it gives to transfer load to or from other stations at will on trackage fed from more than one station. While such advantages would not warrant the cost and added losses of induction regulators or booster converters, they are held to warrant the added cost of the step-by-step arrangement, which was $2,650 per machine, factory cost.

The location of the equipment in the substation differs somewhat from the usual design, which is intended to convey the power generally in one direction from incoming high-tension source to outgoing direct-current delivery. Such an arrangement involves considerable running around by the operator—from high-tension switch control to starting switch, to field switch, to direct-current panel, etc., which slows down restoration of power in emergencies. The substation here described is designed for operation by one man per shift. For this reason all operations are centralized so far as possible, and all control is collected in the immediate neighborhood of the telephone booth, which is treated as the operating center when operation must be made most expeditious, as in emergencies. All high-tension

disconnecting switches between the busbars and the oil switches—commonly called "bus disconnects"—including the busbar sectionalizing switches, are placed within convenient reach from the main floor and in plain view from the operating position. No switches whatever are mounted on the machines. Negative switches are omitted as unnecessary and, the machines being shunt-wound, no equalizing switches are required. The field switches are placed with the alternating-current starting switches on the main switchboard. On account of the large number of cables to each starting switch (fifteen, each 2,000,000 circ.mils in size) it is, of course, advisable to have the starting switches between the transformers and the converters, which results in placing the transformers behind the board. Congestion on and around the main switchboard is avoided by careful lay-outs of cable runs and by the removal from the board of all devices, such as meters and relays, which do not require handling in emergencies.

The station is built for an ultimate capacity of four machines, of which two are now installed, the additional space being sufficient for two 3,000-kw. units, which would, if added, give a total capacity of 10,000 kw., sufficient for all probable downtown demand in San Francisco even with a subway under Market Street. In order to avoid an awkward location of the operating center with either the initial or the final equipment, the two machines first installed were erected in the middle of the station with room for another one at each end.





MECHANISM CONNECTING OVERHEAD SWITCHES WITH BOARD

The converters face in a direction opposite to that found in the usual design of substations, the collector-ring end instead of the commutator end being toward the main working passageway and switchboard. This is done to avoid risk to the operator and nervousness on his part from the danger of flashing under emergency conditions, as when cutting in machines on feeders which may be short-circuited. The arrangement of the converters differs in another radical respect from the conventional. Resorting to a practice abandoned for many years, the bed plates are set on timbers and insulated from ground. This has been done to eliminate the short-circuiting effect of flashovers from positive brush rigging to pedestals or other portions of the frame and to cut out the severe burning that would otherwise occur in case of a breakdown from armature conductors to core. Each frame is grounded through an indicating lamp and suitable resistor to give notice in case of an insulation failure. Risk of shock to operators from live frames is eliminated by the use of an insulating floor as described later.

Unusually convenient access to the lower half of the brush rigging is obtained by mounting the negative busbar in another location, by the omission of all shunts and by keeping all cables out of the way. A removable bench is provided to give a safe, convenient working platform under the commutators. The negative busbar is so assembled that it can be increased in section or extended in length without slacking off its connections.

The site selected for the station has a frontage of 41 ft. by a depth of 80 ft. (12.5 x 24 m.) on a narrow back street immediately next to Market Street. This site was owned by the United Railroads of San Francisco, being the location of an old horse-car stable of the Sutter Street line previous to the San Francisco fire. The building is reinforced concrete with no structural steel below the roof trusses. The problem of adequate lighting, always difficult on a site surrounded by private properties on three sides with a narrow street on the fourth, has been solved by making the whole of the roof of glass. Corrugated, wired glass was used for this purpose, set on one-quarter pitch with 2-in. (5-cm.) slope lap, and it has proved eminently satisfactory in every respect. There is no leakage in downpours or driving storms, though some sheets have been cracked owing to being set on non-parallel purlins and overloaded by the weight of men working on them before the bad supporting conditions were noted. The roof does not sweat nor let in too much heat under San Francisco climatic conditions. Direct sunlight is so diffused that there is no objectionable glare, and the lighting on dark days is infinitely superior to that of any building with side windows or ordinary skylights.

Ventilation is another feature requiring careful attention in a substation of this character, since the manufacturers refuse to design rotary converters with directed ventilation, thus leaving this as about the only class of electrical machinery to "stew in its own juice." The heated air is allowed to escape from this station through the sides of a monitor of the usual design, and cool air enters through louvers provided at both ends to admit air both above and below the main floor. This suffices for the two machines, but mechanically assisted draft will apparently be necessary for four.

The main floor is made large enough to admit a converter assembled, and the machines were shipped in that state. To avoid waste of space with hinged doors and the cost of jack-knife or roller doors, the main door is mounted on vertical slides and is arranged to be lifted by the crane. No door latch or lock is required. The air-blast pressure under the transformers is one ounce per square inch or about 150 lb. (10.5 kg. per sq.cm.) on the area of a door. A small air lock is provided with spring-hinged wickets in the inner and outer doors. The blower dampers are automatic.

The location of the telephone booth in the operating center between the two machines necessitated special soundproofing. The booth is of single-wall construction, lined with 1-in. (2.5 cm.) of hair felt with an inner lining of wall board. The inner windows are celluloid, the joint of the door is weather-stripped, the booth is mounted on rubber posts, and the floor is covered with a rubber mat. The result is almost absolute quiet.

The main floor is finished with 1 in. of Trinidad Lake asphalt mastic, which was preferred to concrete as being less slippery, less dusty and softer under foot. The writer has taken 11,000 volts from hands to ground standing on this floor without sensation except when taking hold and letting go of the circuit.

The high-tension bus structure with all barriers is concrete cast in one pouring. Its longitudinal wall runs up between the line and bus terminals of the motor-operated oil switches, thus keeping any fireworks on the line side from spreading to the bus side. The oil-switch cells have removable doors back and front to provide for easier maintenance and quick cleaning up after breaking heavy loads.

The outside disconnecting switches are double-throw with triple-pole, rod-operated short-circuiting and grounding switches that can be closed on the back throw only when the line is disconnected from the house. This does away with the need of the usual dangerous grounding wire.

All outgoing direct-current feeder panels and circuit-breaking equipment are mounted on timber framework of mill construction in place of the conventional grounded steel frames. This has been done to avoid the chance of short circuit from positive busbar or bare copper connections to the steel frame when working on live circuits. Since the feeders in a downtown district must always be energized and can never be shut down even during the midnight hours on account of "owl-car" service, this precaution is a decided safety-first advantage. On account of the severe circuit-breaker duty occasioned by low feeder resistance to the trolley network, the circuit breakers are not mounted as usual on the feeder panels, where they would be immediately above the head of the man operating them. They are installed in two rows above and behind the feeder switchboards, the double row allowing the breakers to be placed on 32-in. (76-cm.) centers with the panels on the usual 16-in. (40-cm.) centers. Transite barriers are mounted between the breakers, thus isolating each breaker in a cubical cell somewhat similar to the cells provided for high-tension oil switches but open at the top, front and bottom. In case repairs are required or burned-out breakers must be replaced, the operator can work in such a cell with its timber frame, slate and transite walls in comparative safety and is not endangered by accidental grounds or arcing from adjacent breakers.

In addition to the usual 600-volt main busbar, the feeder panels are equipped with what is termed a "hospital bus" supplied from the main busbar through a spare circuit breaker. Each feeder switch is double-throw so that any feeder can be connected via the hospital bar to the spare breaker. All feeders can be interconnected through the hospital bus at times of light loads when the station is shut down, thus allowing the main 600-volt busbar to be de-energized for work on it or on the circuit breakers. Each feeder is equipped with a pilot lamp and suitable resistance to indicate approximate voltage delivered via multiple connections from other stations. This detail was specified in place of the usual voltmeter plug because it was found that operators will not take the time to plug in a voltmeter on a cut-out feeder, but will cut in in a hurry to catch the cars before they slow down—a practice that sometimes has serious results.

In order to ring a gong when the breaker opens, each feeder breaker is equipped with an auxiliary switch serially connected to another auxiliary switch actuated by the corresponding feeder switch which stops the gong when the last-mentioned switch is opened. All switches and breakers have laminated studs.

The direct-current feeders are ½-in. (4-mm.) paper-lead cables varying in size from one of 750,000 circ.mils to three cables per feeder each of 1,500,000 circ.mils. Total positive outgoing copper is 17,250,000 circ.mils, and negative current is returned by eight 2,000,000-circ.mil bare cables drawn into fiber ducts.

NO DIRECT-CURRENT STARTING SWITCHES

The line and converter switchboard has been simplified by the omission of several items often used but found unnecessary. No direct-current starting equipment has been provided, since with the variable-voltage alternating-current starting is always reliable. Instruments have been kept to a minimum. Each incoming line has pilot lamps and an ammeter only. Each converter has a reactive factor indicator on the low-tension side and a direct-current ammeter only. The main direct-current voltmeter has a suppressed zero to give an open scale. A 200-volt center-zero voltmeter is provided to show polarity and can be switched from either converter to positive busbar to serve as a paralleling voltmeter to avoid plugging a voltmeter from bus to machine and vice versa. Lamps are connected from the voltmeter bus to the battery to give a check test on polarity or to serve when the polarity indicator is out of commission.

All connections between transformers, converters and switchboards are made with 2,000,000-circ.mil cables, two per phase and four per direct-current terminal, making twenty such cables to each converter. The cable racks are hard wood held to steel straps by studs and malleable washers. The studs between phases of the alternating-current conductors are brass. All others, including those between cables of the same phase, are

steel. All cable lugs were sweated on the ends of the cables, standing up in position.

Automatic protective features are as follows:

The machine circuit breakers are equipped with alternating-current low-voltage release attachments connected to centrifugal speed-limit switches and direct-current reverse-current relays. The alternating-current converter switches are equipped with inverse-time-limit overload and instantaneous low-voltage relays, the incoming lines with reverse-power relays. Plug switches are provided by means of which the winding of any relay may be energized from toy transformers with an overload current capable of adjustment, and in the case of the incoming lines with the proper phase and polarity. Thus the complete test of any relay may be made a routine operation.

The watt-hour meters are connected to triple-pole, double-throw switches for testing purposes which accomplish the following results. First, the current-transformer secondaries are cut off from the meters without opening the circuits of the current transformers but leaving the current coils of the watt-hour meters open. The potential coils of the two torque elements of the meter are connected in multiple and the current coils in series. As a result, either with the meter in service or out of service, the meter tester may from the front of the board make all necessary connections for the supply of and delivery from a phantom load, for testing each torque element of the meter and for making a check test on the two torque elements in series. The switch may then be sealed in the running position. An indicating lamp is connected across each potential coil of each meter to give notice of the blowing of any fuse, either primary or secondary.

Artificial Lighting

Current for lighting the station is taken from the direct-current busbars as being the most continuously energized part of the network. At night the station is closed down and all the alternating-current equipment is disconnected for a general clean-up by the night shift. All direct-current lighting circuits consist of four 115-volt lamps in series, charging the control storage battery. No other charging equipment is required. A low-voltage release is so connected as to light automatically from the battery a sufficient number of lamps to illuminate the control center when direct current fails at night.

The converters, transformers and direct-current switchboards are of Westinghouse manufacture. The high-tension switching equipment is General Electric.

The cost of the development, including transmission lines paid for by the power company, was approximately as follows:

Building	$51,000
Equipment, f.o.b. factory	76,000
Freight and installation	21,000
Conduits and manholes	33,500
Cables, positive, installed	32,000
Cables, negative, installed	7,500
Transmission lines	75,000
Engineering and overhead	40,000
Total	$336,000

The station was designed for the United Railroads of San Francisco by Ford, Bacon & Davis, consulting engineers, who also superintended the construction of the building and of the conduit system required therewith and the installation of all equipment, cables, etc.

Variation in Costs as Affecting Distribution Design

It Is Shown that Energy Lost in the Line Costs More than Energy Used—Effect of This on Design of Distribution Systems

By P. O. Reyneau* and H. P. Seelye**
Detroit Edison Company

THE accurate determination of cost of construction and cost of energy as a basis for economical design were dealt with in the last installment of this series on "Economics of Electrical Distribution," printed in the Jan. 15 issue, page 146.

Further Variations in Energy Cost

Up to this point only the average unit cost of the total energy delivered has been considered for any type of load and locality, without attempting to differentiate between costs for large loads and small loads of the same type, high power factors and low power factors, losses and used power, etc. There will now be indicated some of the possible variations in this cost, and methods of studying them will be suggested. It may be shown that all units of energy, even of the same class and locality, do not cost the same. For example, energy lost has a higher unit cost than energy used. Again, not only does the total kva. of any load increase as power factor decreases, but that increase costs more per unit than the average cost if a 100 per cent power factor were obtained. Further, under some conditions an increase in a load will cost more per unit than the former average.

The underlying theory involved may be readily seen if we consider the cost of lost or waste energy, for example. Most substations are regulated in some way, and if the energy losses between the substation and the customer could be reduced the current in the transmission cable to the substation would be also reduced. Since losses are proportional to the square of the current the cable losses eliminated by this reduction of the load on the cable would be proportional to the difference in the squares of the currents before and after reduction. Hence it will be seen that reduction in loss per unit reduction in load is greater than the average loss per unit of the total load after reduction. In other words, the loss in the cable due to the upper part of the load, which may be eliminated and hence may be considered waste, is greater per unit than the loss due to useful load. Since this energy must be supplied at the generating plant the energy generated will be more per unit for this waste energy than for the remainder of the load or useful load, and the cost will hence be more. This may be shown mathematically as follows:

Suppose a substation B is supplied through cables from a generating station A, and let

W = load in watts at B,
P = percentage of W lost beyond B, which may be considered waste power which might be conserved in some way,
p = $P/100$,
E = voltage at B,
R = resistance of cable.

For simplicity assume single-phase cables, unity power factor. Then

*Distribution engineer. **Distribution department.

I^2R losses in AB due to total load $W = 2\left(\frac{W}{E}\right)^2 R$,

I^2R losses in AB due to power load only $=$

$$2\left(\frac{(1-p)W}{E}\right)^2 R,$$

I^2R losses in AB due to losses beyond B $(= pW) =$

$$2\left(\frac{W}{E}\right)^2 R - \left(\frac{W}{E}\right)^2 R + \left(\frac{W}{E}\right)^2 R\,(2p - p^2),$$

or, expressed in percentage of total loss in AB,

$= 100\,(2p - p^2) = 2P - (P^2/100)$ per cent. (1)

If the loss or waste power at B is a comparatively small percentage of W it will be seen that the losses in AB due to that waste are nearly twice that percentage of the total losses (10 per cent waste at B means that 19 per cent of losses in AB is due to that waste).

If Q = percentage of W lost between A and B,

$\frac{QW}{100}$ = total loss in cable,

$\frac{QW}{100}\left(2P - \frac{P^2}{100}\right) 1/100$ = loss in cable due to waste beyond B. But waste beyond $B = PW/100$.

Hence the loss in the cable due to waste beyond B per unit waste

$$= \frac{\frac{QW}{100}\left(2P - \frac{P^2}{100}\right)1/100}{PW/100} = Q/100\left(2 - \frac{P}{100}\right), \quad (2)$$

since the average total loss in cable per unit total load at $B = Q/100$. If cost of energy per kw. at $A = C_e$, average cost at A of total energy at $B =$

$$\left(1 + \frac{Q}{100}\right)C_e, \quad (3)$$

and average cost at A of energy waste beyond $B =$

$$\left[1 + \frac{Q}{100}\left(2 - \frac{P}{100}\right)\right]C_e. \quad (4)$$

In other words, a loss of Q per cent in line AB increases the average cost of total energy delivered at B by Q per cent. But if P per cent of that total energy represents losses which may be assumed to be reducible or waste the average cost of such losses is increased by $Q\left(2 - \frac{P}{100}\right)$ per cent. The difference in average unit total cost and average unit waste cost is then

$$\frac{Q}{100}\left(1 - \frac{P}{100}\right)C_e,$$

or

$$\frac{\frac{Q}{100}\left(1 - \frac{P}{100}\right)100}{1 + Q/100} = \frac{Q\left(1 - \frac{P}{100}\right)}{1 + Q/100} \quad (5)$$

per cent of average cost at A of total amount of energy delivered at B.

For example, if 1,000 kw. be transmitted over a line for one hour with a loss of 6 per cent and if 10 per cent of that 1,000 represents reducible losses or energy wasted beyond the end of the line,

$$P = 10, \qquad Q = 6.$$

If energy at A cost 0.01 cent per kilowatt-hour the average cost per kilowatt-hour delivered at B, including losses in AB but not fixed charges on line $= (1 + 6/100)\ 0.01 = 0.0106$ cent per kilowatt-hour (from equation 3).

The average cost of energy waste beyond B is

$\left[1 + \frac{6}{100}\left(2 - \frac{10}{100}\right)\right] 0.01 = 0.01114$ (from equation 4).

The difference is 0.00054, which is 5.1 per cent of the average. The same percentage of increase would be obtained from equation 5.

$$\frac{6\left(1 - \frac{10}{100}\right)100}{100 + 6} = \frac{540}{106} = 5.1 \text{ per cent.}$$

It must be noted that the above deals with the average cost at A of energy delivered at B. In order to determine the average cost at B of energy delivered at B the charges on the line AB must be included. These should be practically proportional to W and hence would average the same per unit both for useful load and for losses.

The above merely establishes the fact of the increased cost of waste energy and must not be considered as indicative of the actual amount of that increase. In determining this a number of variable quantities must be considered.

1. The demand charge for waste energy at any point should be figured by the second method given under that heading, *i.e.*, making up the demand charge for any load of charges proportional to the amount of that load at the time of peak load on station, transmission cable, substation, etc. The reason for this is seen when it is considered that the demand cost on the station, for example, is considered proportional to the station peak. If that peak can be reduced by eliminating waste energy (without reducing the useful load) the demand cost will be likewise reduced in proportion. This line of argument does not apply to useful load, since for this the company is receiving a return. The actual demand cost should be distributed to such loads by the more equitable third method. In other words, a reduction of losses at off-peak time would not affect the actual demand cost of the station nor the distribution of that cost among the useful loads. A reduction of useful load at off-peak would reduce the revenue and hence increase the cost to other loads.

2. The example above uses the energy charge as a single total charge per kilowatt-hour and the loss at a definite percentage. Since the per cent loss varies as the load varies during the day the increase in cost will not depend on the per cent losses at maximum load. The variation in loss will affect both the demand charge and the kilowatt-hour charge, and each in different proportion.

3. If several loads of different sizes and characteristics are considered the problem is further complicated.

4. If lines are operated under the most economical load the losses may be considered as useful load rather than waste.

As has been stated before, the theory here explained can also be applied to determination of the additional cost of low power factor, of load increases (in some cases) and other similar problems. It would appear that each unit of energy comprising any load might be conceived as having a different cost. In dealing with increases in useful or salable load we have the further consideration of economical loading of lines, so that it would not be correct to say that an increase in load always costs more per unit than the average unit cost before the increase. In dealing with losses, however, a large percentage of loss may be assumed

to cost more per unit than a small percentage. This idea of increased cost of losses and waste energy is an important one to bear in mind in all economical studies, since usually such a study is fundamentally the establishing of the most economical relation between cost of energy loss and other costs.

CONCLUSION

The above is intended to be rather a suggestion as to how the problem of cost of energy and energy losses may be studied than a complete solution or a recommended method to cover all cases. It may be easily seen that the study of energy cost might be carried to an almost infinite degree of refinement. Many economical studies are general for any part of a system and are intended to cover a period of time well into the future. For these cases a very detailed determination of energy cost would not seem necessary. If the more accurate costs are once determined, however, they can easily be averaged for a more general problem. Lack of time and of the necessary data will, in many cases, limit the study to more or less approximate results. It is hoped, however, that the methods and principles here explained will give a good idea of the nature of the problem. Detailed analyses of energy cost, when data are available will well repay the effort expended. Even a more approximate study with these theories in mind will indicate the relative costs of energy at various parts of the system of various types of loads and the relation between the cost of waste and useful energy.

Teaching the Employee to Be the Company

An Experience in Oklahoma Based on Importance of Educating Employees to Develop Responsibility and Self-Respect in Relations with Public

By J. F. OWENS
Vice-President and General Manager Oklahoma Gas & Electric Company

WE HEAR much these days about "public relations" and "good-will" activities. I believe that we cannot hear too much about these very important matters and a little repetition on these fundamental subjects will not hurt us. But I am convinced that in dealing with the broad phases of these two considerations we have extended our vision and our consequent analysis of particular requirements before we have thoroughly and completely examined and analyzed conditions near at hand. We have sought the answer to our peculiar problems largely through various methods calculated to educate the public and have perhaps paid too little attention to elements within our own organizations which seem to me to be vital to successful and friendly relationship between a utility company and its customers.

The good will, loyalty and intelligent co-operation of every member of a utility organization form the first requisite of public good will. We cannot hope for public co-operation without first making sure that our entire organization is willing and anxious to co-operate with the public. Nor can we effect harmonious conditions between our customers and our company unless we create within the public mind a cordial and friendly understanding of our peculiar problems. The whole matter cannot be worked out successfully through a one-sided arrangement. I believe, therefore, that first of all in dealing with this subject of public relations come "company organization" and "employee education."

It goes without saying that the ideal situation is one in which every employee, all the way down the line from superintendent to ditch digger, thoroughly understands the company's attitude toward customer and public and is earnestly striving loyally to co-operate in promoting friendly relations, as well as to render satisfactory service. This is the goal which I assume all of us are trying to reach.

No situation in any utility organization is of so little importance that it does not warrant the use of the greatest care in the selection of the man or woman who is to fill it. Particularly is this true of those positions where the nature of the work is such that the employee filling it is brought into contact with the public. Ambition is an essential qualification in any member of the organization. The man who has not a forward outlook will prove a drag on the company which employs him. It is not enough that a man be ambitious for himself. He must learn team work, and this means recognition of the fact that his best interests lie in the direction of loyal, intelligent co-operation with his fellows. I wish here to emphasize the word *intelligent*. Le me illustrate!

The company with which it is my privilege to be associated deals in both electricity and gas. Two years ago we were very short of gas. The producing company delivered to us only half enough to supply domestic needs on cold days. Frequently the electric meter setter or troubleman was asked, "What's the matter with the gas?" He did not know, and the inquirer immediately assumed that the company was trying to conceal something in connection with the gas situation.

We decided that it would be advantageous to start a rudimentary course of instruction on the "whys and wherefores" of the local and general gas situation. Department heads were requested to select three employees from each department who in the course of their work came in contact with the public frequently. Those selected were asked to meet for an hour twice each week. Classes were held from 11 to 12 in the morning, in company time. The gas situation as it changed and developed was discussed, and every member of the class was thoroughly informed on all of its phases. This beginning was followed by talks on other activities connected with our company by the men in our organization best fitted to handle each subject. Among the subjects discussed were gas and electric meters, engines

and boilers, distribution systems, transformers and protective devices, transmission lines, the storeroom and the history of an order from the time it is made out in our offices to the completion of the work directed.

Another class of twenty succeeded the first, and now fifty-three members of our organization are taking a correspondence course with the understanding that upon its successful completion our company will refund one-half of the price of the cost. This is being done on the theory that the additional intelligent service rendered by those completing the course warrants the expenditure.

The first result of the preliminary school, if we may so call it, was that department heads, through co-operating with other department heads, were brought into close contact with one another's problems. Then the meter setter got a peep into the mysteries of the office and its method of operation and was allowed to see just how his failure to use care in making out his reports threw one of the cogs out of mesh and destroyed the efficiency of the entire machine. The contract clerk was conclusively shown in just what manner the incorrect address he wrote down on an order cost an extra trip, with consequent delay not only to one but to many waiting customers. All of these details were tied in with the paramount idea carried throughout the course —the idea of service.

The purpose of this recital of our company's activities is primarily to emphasize the importance of developing the good will, loyalty and intelligent co-operation of every member of a utility organization as a first requisite of public good will. Only when an employee has pride in the organization with which he is connected can he really give of himself fully and freely in its service. The development of this pride is a prerequisite to loyal service. There can be no set formula for its development. I have therefore avoided any seeming attempt to do so through laying out an organization chart.

Military men have long recognized the value of this pride in organization and have for ages used every resource to build up what they have termed "esprit de corps." The value of this intangible, difficult-to-obtain spirit of unity and organization pride has been conclusively demonstrated many, many times under the most trying and chaotic conditions on the field of battle. Its value to the individual and organization in stress of battle or routine of commercial activity is obvious.

Employees' organizations have helped where they are really employees' organizations. They serve as an outlet for the development and expression of the individual and the department as well as of the workers as a whole. Group insurance has been found a decided factor in creating a feeling of permanency on the part of the employee in his position. All of these factors are valuable and effective if they are introduced and carried forward in a manner that does not smack of paternalism. Any method used should aim to increase in the individual employee an ambition to go forward, and it should above all give the employee the greatest freedom in realizing his ambition.

The whole point I am trying to make is that the organization, be it large or small, is the first and most important element to consider in any attempt to bring about the proper attitude of the public toward a utility or, for that matter, toward any company. How many managers really know exactly what happens to a complaint when it is telephoned to the office? How many have really studied the nervous system of their organization to learn whether or not it is functioning properly and in a healthy manner? Our telephones and messenger systems are our organization's nerves. Does Mrs. Jones when she calls to say that she has misplaced her card and does not know the amount of her bill get the troubleman on the wire? Or does Mrs. Brown, who has discovered a gas leak at her meter, tell her story to the cashier before she learns that she should have been connected with the gas-trouble department? Is your switchboard operator a young and giddy person who spends most of her time snatching excerpts from current love stories or is she a woman of tact and judgment who knows just what telephone to ring when the irate customer is on the other end of the line?

If you have not made an honest, careful appraisal of your own organization, it would pay you to do so systematically, and it might pay you to begin with one of the most important individuals in the entire mechanism—the telephone operator. The contract and adjustment clerks, the cashiers, commercial men, the meter readers and meter setters, the troublemen—all are important links between the utility company and its customers. To the customers they *are* the company, for they are for the most part the only live, flesh-and-blood beings representing the company with whom the customer ever comes in contact.

The subject of "company organization" is one which does not lend itself to brief discussion. But it is also a subject concerning which a few general principles apply and cover the broad phases of its application. The method of satisfying these general requirements is largely a local one and must be dealt with on that basis.

I have unbounded faith in the sound sense and ultimate fairness of the American public. I am confident that the solution of our public relationship problems can be found in intelligent and persistent efforts to render courteous and friendly co-operation, as well as good service, from every department of our organizations, attended by a practical and broad-minded policy of education calculated to enlighten and inform the public concerning our business, its operation and its problems.

Wet Arc-Over at 485,000 Volts

(Photo Courtesy General Electric Company)

SOURCES of high potential varying from 300,000 volts to 750,000 volts have been available for general experimental and research work in several of the best equipped laboratories for some time back, but the fact that such voltages are now necessary for commercial tests is well illustrated in this photograph, which shows a transformer terminal bushing being subjected to arc-over voltage under rainfall conditions.

To cause the arc-over 485,000 volts was necessary. The test was purely a commercial one on bushings that have recently been shipped for use on a 220,000-volt transmission system.

Lower Labor Costs with Bigger Pay Envelopes

Outline of a Principle of Sharing Saving with Employees Which Is Getting Results in a Middle Western Public Utility Company

BY WILLIAM BAUM
Of William Baum & Company, Chicago

FIXED daily, weekly or monthly wage rates cannot and do not stimulate the workers to do their best. A scientific system of wage payment, however, based on metering of efforts, has in one of the Middle Western utility companies provided a strong incentive. This system allows an employee to earn a wage in excess of the ordinary compensation and thus benefits not only the worker but the corporation and the public as well.

It is more and more being recognized by employers that the workers should in some way share in the profits resulting from their individual efforts. The gain-sharing system as proposed by F. A. Halsey in a paper before the American Society of Mechanical Engineers in 1891 (*Transactions*, Vol. XII) is particularly adaptable to public service companies and has been in operation with slight modifications in one of the large electric railway, power and light companies in the Middle West. The words "gain sharing" are used in preference to "profit sharing" as the workers receive a monthly premium for individual or group accomplishments rather than a share of the company's profits over which they have only indirect and partial control.

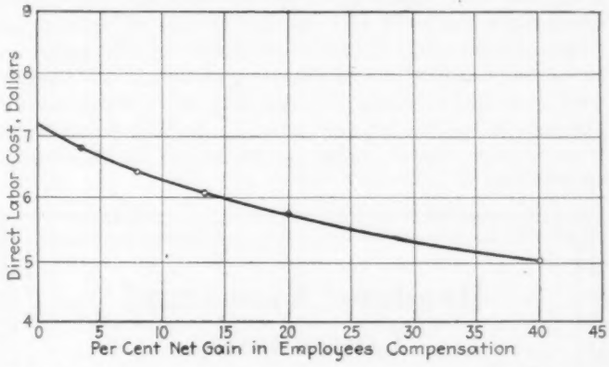
Under the principle of gain sharing the worker, or a group of workers, has allowed to him a definite and carefully determined standard time for performing a given operation, and if the work is done in less time—

SOME UTILITY EMPLOYEES WHOSE SERVICES HAVE BEEN SUCCESSFULLY METERED

Department	Participants	Efforts	Basis of Gains	Standards
Power plants	Engineers, Firemen, Mechanics, Oilers, Cleaners, Coal checkers, Helpers	Group	Saving in fuel	B.t.u. per switchboard kw.-hr.
Electrical distribution	Overhead	Group	Saving in labor	Man-hours
	Underground	Group		Man-hours
	Meter installers	Indiv.		Man-hours
	Meter testers	Indiv.		Man-hours
	Troublemen	Indiv.		Man-hours
	Engineers	Group		Man-days
	Clerks	Group		Clerk-days
	Stores	Group		Man-hours
Way and structure	Construction	Group	Saving in labor	Man-hours
	Reconstruction	Group		Man-hours
Repair shops	Repairmen	Indiv.	Saving in labor	Man-hours
Accounting	Meter readers	Indiv.	Saving in labor	Man-days
	Credits and collections	Group		Clerk-days
	Billing	Indiv.		Clerk-days
	Accts. receivable	Group		Clerk-days
	Railway receipts	Group		Clerk-days
	Bookkeeping	Group		Clerk-days

i.e., at lower cost—a gain results, in which he shares with the company in a fixed proportion. For example, let the allowed or standard time for setting a 35-ft. (10.7-m.) wooden pole in dirt be twelve man-hours, a figure obtained by time study and fatigue allowance and checked with data obtained from past performances. If the pole gang performs the task in eight man-hours, a gain of four man-hours is accomplished, which under an existing agreement is shared with the company in equal parts. Thus, the net gain payable to the gang is two man-hours, or 25 per cent more than the compensation for the actual time of eight hours of work. This percentage is applied to the minimum or basic rate of each worker and constitutes his premium or bonus. In this particular operation gain sharing is based on group efforts. The same principle applies to individual gain sharing.

The application of the system to thousands of operations requires considerable engineering and clerical work, the expense of which may be met by deducting from the gross gain the cost for operating the system, usually about 20 per cent, and dividing the balance equally between the company and the employees. Deducting the cost of operating the system from the gross gain has been practiced for several years and is accepted by the employees in good faith. Gain sharing is also applied to reduce cost of materials, tools, expenses for injuries and damages, etc. Each department of a public service corporation presents new features, and no all-inclusive description of gain-sharing designs can be given. The co-operation of foremen and superintendents is desirable and is secured by allowing them to participate in the gains. In some plants demerits or special penalties for infraction of rules are also introduced.



LABOR COST OF SETTING A 35-FT. POLE WITH WAGES AT 60 CENTS AN HOUR UNDER GAIN-SHARING PRINCIPLE

The setting of correct standards presents the most difficult problem and one upon which the success of gain sharing depends. Proper allowances must be made for fatigue and delays. It is important that the computed time allowances be checked with a production study or with records of past performances. Standard time allowances must be made of sufficient magnitude to induce the best results. The writer's experience has shown that a premium of from 25 per cent to 50 per cent offers a sufficiently strong incentive to workers of public utility companies.

A partial outline intended to give a bird's-eye view of some of the more important departments to which gain sharing has been successfully applied is given in the table. Gain sharing is not limited in its application to operating and construction departments, but is also particularly fruitful in the case of clerks, bookkeepers, auditors and other office employees. Though it may appear at first that the metering of office work would offer too many obstacles, the application of gain-sharing plans to accounting departments has been particularly successful. In fact, in order to insure an all-around success and the enthusiastic co-operation of all employees, gain sharing should be applied to all departments.

The actual gains vary from month to month and in some cases are of considerable magnitude, as is shown by the following figures for a large Middle West company in one of the last months of 1919:

Department	Monthly Gains Paid to Employee
Accounting	$3,745.51
Electrical distribution	4,058.10
Purchasing	379.09
Rolling stock	10,123.46
Sales	2,416.78
Transportation	34,321.87

As the gains reflect the efficiency of a particular individual, group or department, the executives to whom the results of gain sharing are submitted monthly in graphical representation have a complete and ready check upon the work and the efforts exerted during the preceding month. If the curve showing the gains in percentage indicates a decreasing tendency, an investigation should be made for the purpose of determining the reason and the proper remedy. Employees showing a continuous rise in gains can be placed in the line of promotion.

Readers' Views and Comments

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Export Possibilities for Electrical Products in Italy

To the Editors of the ELECTRICAL WORLD:

The Italian industries are suffering badly from German and Austrian competition. Italy produces no coal and no iron, and therefore the cost of manufacturing is much higher in that country than in Germany and Austria. Recently, when an order was placed for equipment for a hydro-electric power station, the German offers were 3,000,000 lire less than the Italian bids (9,622,000 lire against 12,600,000 lire). The German price included freight and duty. The prices for Italian-made electrical machines have risen considerably during the last few years. Thus, for instance, an electric motor of 50 hp. which before the war could be had at 1,350 lire (190 lire per 100 kg.) was sold at the rate of 5,650 lire (800 lire per 100 kg.) in 1919 and at 13,000 lire in 1920 (or 1,820 lire per 100 kg.).

In former years Switzerland exported considerable quantities of electrical machinery to Italy, but these exports have largely decreased as will be seen from the following table:

	1920 Twelve Months, Francs	1921 First Quarter, Francs
Dynamos, electric motors	1,231,000	469,000
Electrical control instruments and apparatus	2,457,000	387,000
Other instruments and apparatus	820,000	117,000
Incandescent lamps	3,029,000	667,000

An especially large decrease took place in the Swiss exports of electrical control instruments and apparatus to Italy, as well as in the exports of incandescent lamps, of which 60 per cent went in 1920 to Italy. Out of a total exportation of 5,250,000 francs, lamps to the value of 3,000,000 were shipped to Italy. The electrification of the Italian railroads requires the importation of large quantities of electric products of nearly every description, above all of porcelain and glass insulators (for 12,000 volts to 80,000 volts) and steel pipes for poles. The Italian government recently objected to an increase of the customs tariff on those articles, and therefore, the market offers opportunities for the sale of such appliances, provided that the German competition can be beaten.

HENRY L. GEISSEL.

Beaurivage, Thoune, Switzerland.

How X-Ray and Radio Service Problems Have Been Solved

To the Editors of the ELECTRICAL WORLD:

Inasmuch as the Duquesne Light Company has supplied electric service for X-ray and radio apparatus over a period of about six years, it is possible that readers of the ELECTRICAL WORLD will be interested in its experience along these lines.

Owing to the operating characteristics of X-ray apparatus, many cases of flickering lights occurred when we first served such apparatus. However, these disturbances have been eliminated by the installation of 2,200/110-volt transformers and services. Such an arrangement provides the X-ray operator with ideal service since he requires uniform voltage after he has set a machine to make an exposure. Since the X-ray machine is operated by professional men who derive a revenue from its use, they understand business problems, readily appreciate the necessity for special service and rarely hesitate to meet the central-station company half way. The result has been universal satisfaction relative to the operation of X-ray apparatus on the lines of our company.

The amateur wireless operator, however, has caused us considerable annoyance. The transmitting outfits have been the chief trouble makers. The following cases which I have selected from a hundred or more investigations will illustrate our difficulty and the remedy which we applied:

Several years ago a customer complained of flickering lights and electrical discharges similar to but not so severe as lightning. It was found that a wireless transmitting outfit was situated next door and that the flickering lights and discharges occurring on the switches and chandeliers were in synchronism with messages that were being transmitted. Grounding of the wireless outfit through various values and types of impedances in numerous ways was attempted, but no relief was obtained. A one-to-one transformer was also inserted in the wireless supply circuit without effect. Finally the wireless customer was disconnected from the 110/220-volt grounded-neutral distribution bank and served from a 1-kva., 2,200/110-volt transformer installed for his individual use. The disturbance ceased and was permanently eliminated.

In another case the wireless amateur had attached one end of his aërial to one of our poles which carried a three-wire 110/220-volt distribution circuit and four or five customers' services. The aërial crossed the services at various angles and not more than two feet distant from any of them. During rainy or damp nights, when the operator was transmitting, streams of fire could be seen between the aërial and our service lines

directly beneath. The lights on these circuits flickered, the wall switches and chandeliers buzzed and emitted sparks, the telephone service was affected, and in one case the main house fuses were blown. The same disturbances occurred, but to a less degree, on dry nights and days. The aërial was removed to a safe distance, but the trouble was not completely eliminated until a separate 2,200/110-volt transformer was installed for serving the radio operator.

A more severe case of disturbance occurred quite recently. A wireless transmitting outfit broke down the insulation on the chandelier wiring in one room of the house next door. The ceiling canopy was melted and a hole 6 in. in diameter was burned in the ceiling. The main house fuses and tablet board were badly burned. The wireless customer compensated his neighbor for the damages, and we prevented repetition of the trouble by installing a 2,200/110-volt transformer to serve the wireless outfit.

Generally the amateur wireless sending outfit is found in the hands of a person operating it solely for pleasure, consequently he objects strenuously to any expenditure to obtain electric service. He does not even care to consider the viewpoint of the central-station company and does not understand why other persons should be annoyed by their light flickering and sparks flying around. He likes to see the sparks fly. He does not realize that for his own and the other persons' safety he requires a special service and that consequently he must bear the additional cost which is incidental to supplying that class of service.

From our experience, coupled with laboratory and field tests, we have developed our present policy relative to serving these two outfits. Briefly stated, it is as follows:

1. A separate 2,200/110-volt transformer and service is installed in all cases.

2. The wireless operator must keep his aërial 30 ft. from our lines.

3. Since the energy consumed is very low and the cost of connection and service, including the core loss of the specially installed transformer, is comparatively high, the customer must bear a share of this cost connection and then pay a monthly fixed service charge thereafter.

C. H. MUELLER,
Superintendent of Electrical Testing Division.
Duquesne Light Company,
Pittsburgh, Pa.

Ebro Irrigation Power Company's Development

To the Editors of the ELECTRICAL WORLD:

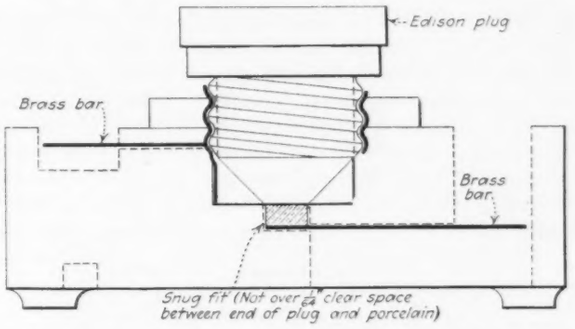
Please refer to the letter "Would Be World Record" on page 172 of the July 23 issue of the ELECTRICAL WORLD. This communication is in part from a letter I sent you on June 7 which was not intended for publication. That part of the first paragraph which refers to P. L. Griffith is so erroneously stated as to require correction. In our letter of June 7 we stated: "A friend of our P. L. Griffith recently returned from Spain, and he, while there, was superintendent of electrical construction," etc. Mr. Griffith's friend, not Mr. Griffith himself, was superintendent of electrical construction. It was from this friend that we obtained the information given you.

M. W. BROWER,
Statistical Department.
Electric Bond & Share Company,
New York City.

Proper Design of Cut-Outs and Fuses to Prevent Practice of Bridging

To the Editors of the ELECTRICAL WORLD:

I have noted with interest the comments of your readers about bridged fuses. This is probably the most flagrant violation of safety requirements. In fact, nearly everybody except those who understand the serious nature of the practice is using coins and other foreign substances to replace blown fuses. The result is an increasing frequency of electrical fires caused in this way. Electrical inspectors find pennies in nearly



METHOD OF MAKING FUSE PLUG VIRTUALLY PROOF AGAINST TAMPERING BY AMATEUR ELECTRICIANS

every electrical installation, and even the housewife now keeps a handy penny near the cut-out so as to be sure of immediate service.

A number of cities have enacted ordinances requiring sealed service fuse inclosed so as to insure that there will be at least one real fuse in the line at all times, but even these sealed cabinets are broken open and coins substituted. Perhaps a rigid enforcement of the electrical ordinances would tend to discourage this practice, but the difficulty lies in the prohibitive cost of a systematic reinspection of all electrical installations at frequent intervals; therefore most of the laws along this line are inactive and the violator is not brought to trial until after the damage has been done. Here, as elsewhere, an ounce of prevention is to be preferred to a pound of cure.

The only feasible way of handling this problem in a satisfactory manner is to design a cut-out and fuse that cannot be readily bridged. I doubt if there will ever be a cut-out designed that cannot be bridged by an expert, but it is a very simple matter to design a cut-out and fuse that would be very difficult for every householder to bridge and that could not be bridged by a coin.

I am inclosing a sketch of such a cut-out and plug designed by the writer. It will be noted that the only change is to make a depression in the porcelain receptacle and a corresponding raised terminal on the plug fuse. If a bayonet joint is substituted in place of the ordinary Edison screw shell, it would make the cut-out of even greater value, for the reason that the plug and cut-out threads would not meet unless the plug was firmly seated in the cut-out. It is difficult to get manufacturers to adopt new standards, but it is only a question of time when something must be done to eliminate the extra-hazardous features of the present design.

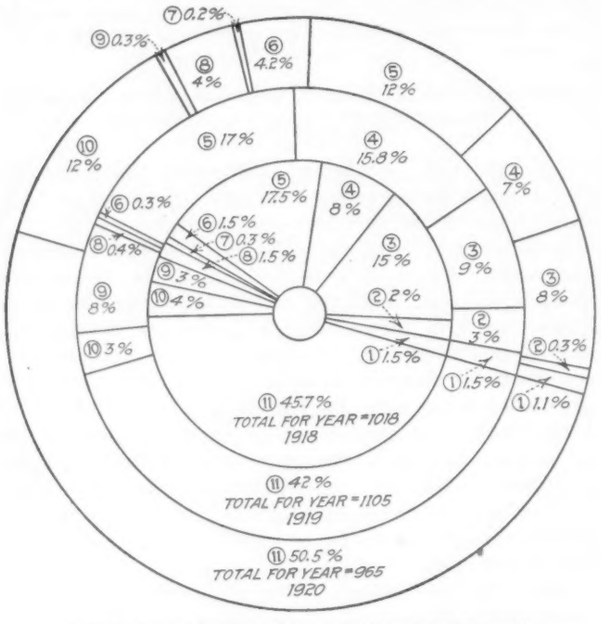
GEORGE WELMAN,
Chief Electrical Inspector.
Louisiana Fire Prevention Bureau,
New Orleans, La.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Graphic Method of Analyzing Interruptions

FOR the purpose of analyzing the causes of trouble on the system of the Georgia Railway & Power Company a chart such as that shown in the accompanying illustration has been prepared. This chart gives the total number of interruptions for each of the last three years. Each ring representing one year is divided off into segments showing the percentage of interruptions due to various causes. The conclusions to be drawn from the circular chart are different for each



CAUSES OF INTERRUPTIONS FOR LAST THREE YEARS ARE PROPORTIONED ON THIS CHART

Numbers on chart refer to causes listed below: 1. Company's switching errors. 2. Overloads. 3. Clearance orders testing and switching. 4. Other connecting company's line trouble. 5. Failure company's apparatus. 6. Failure customer's apparatus. 7. Careless operation by customers. 8. Sleet and wind. 9. Unknown. 10. Miscellaneous. 11. Lightning.

kind of interruption. For instance, if it is desired to know whether or not the operators are becoming more careful than they were in the preceding year reference would be made to segment No. 1 on each of the circles. On this chart the interruptions of this class were 1½ per cent during the years 1918 and 1919 and for 1920 they are 1⅒ per cent, which is an indication that the operators are becoming more competent.

It may be desired to find out how many breakdowns were due to failures of the company's apparatus during the year. This item is shown by segment No. 5. If this segment shows a larger percentage in one year than it did in the preceding year this indicates that a more thorough inspection system should be put into practice or it may indicate that the equipment is getting old and more easily subject to trouble, etc. If a comparison is made between the number of interruptions due to lightning, which is marked segment No. 11, with the amount of apparatus damaged during the year, this will form a basis for determining whether or not sufficient lightning protection is being installed on equipment.

An interesting item in the chart is the number of interruptions caused by other companies. These troubles of connected companies are reflected upon the system and cause interruptions on the branch circuits of the system. Out of the total interruptions for the year 1920 about 8 per cent were due to this one cause.

G. A. ILER,
Superintendent Operation, Tests and Repairs.
Georgia Railway & Power Company,
Atlanta, Ga.

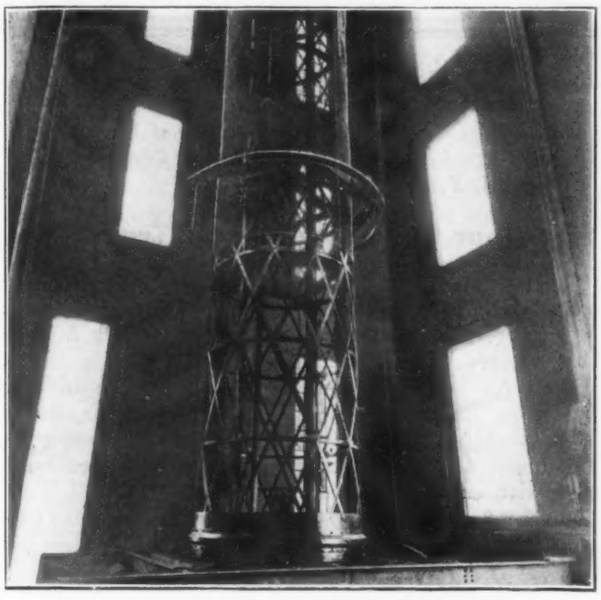
Cylindrical Screen Takes Tons of Leaves from Condensing Water

ON ACCOUNT of the past success of a set of screens for condensing water in a station of the Louisville Gas & Electric Company a second set of screens was built recently. The object of the screens is to catch leaves and other trash. In flood time the highest amount of water which at present passes through the screens is 100,000 gal. per minute, or 60,000,000 gal. in a day of ten hours. The amount of trash will vary from a basketful when the river is clear to five or six carloads at times when a heavy storm has come upon the watershed, with the watershed covered with leaves. It is these peak loads that were formerly feared. A cartload of leaves, distributed flatwise, will stop up a very large area of screen. As soon as a screen is stopped it acts as a dam. The water piles up in front of it and goes down behind it, and in the case of a flat screen five or six minutes is frequently long enough for the differential pressure through the screen to become so great that it is impossible to raise the screen for cleaning without putting the machines non-condensing. If the station is loaded at the time, running non-condensing not only sacrifices economy but it takes off one-half the capacity and would amount to dropping a large portion of the load during the period that the screens cannot be cleaned.

To overcome these objections a triple set of cylindrical screens was built. These screens consist of three cylindrical screens one inside the other. They are about 63 ft. high and the outside screen is 16 ft. in diameter. Each cylinder is built of lattice work supporting No. 10 wire mesh with ½-in. openings. Any one cylinder may be raised independently of the other. The illustration shows the second screen during construction. It stands on a temporary platform which was removed as soon as the screen was finished. The pan which catches the water is shown under this platform. As soon as the

screen was finished this platform was removed and the screen was lowered into a well previously prepared.

The water comes into the inside of the center screen and passes outward through all three screens, except during times when a screen is being cleaned, and then it passes through only two screens. The pressure of the water is equal in all directions, so that no matter



CIRCULAR SCREEN WHICH FILTERS CARLOADS OF LEAVES OUT OF CONDENSING WATER

how great the differential pressure may be, owing to the partial clogging of the screen, the screen can still be raised and cleaned. Cleaning is done by raising the screen and turning water into two pipes permanently erected so that they throw jets of water against the screen along its entire length. The jets of water strike the screen tangentially and cause it to rotate so that every part is cleaned.

There is a wire basket running around the bottom of the screen which catches all the matter that falls off the screen while it is being hoisted. Otherwise this material would pass to the second screen and would eventually reach the condensers.

At periods when heavy rains have followed a leafy summer and a late fall all the leaves come down the river at once and these screens have caught literally carloads of them. None of them, however, reached the condensers, and the cleaning of the condensers once every three weeks has been found sufficient. This plan for screening water is covered by Patent No. 1,207,776.

DONALD MCDONALD,
General Manager.

Louisville Gas & Electric Company,
Louisville, Ky.

Arc Lamps Changed Over to Incandescent Type

TO REDUCE maintenance costs on its street-lighting system and to allow equipment to be used more efficiently, the Augusta-Aiken Railway & Electric Corporation is changing over from alternating-current inclosed series arcs to the compensator-type fixture with incandescent lamps.

This company has for years been operating some 300 series arcs on its 7.5-amp. series system, and in a great many cases it was necessary that series incandescent and series arcs be operated on the same circuit. It was decided some months ago to convert all arcs to compensator-type fixtures with auto-transformers rated at 7.5 amp. to 20 amp. and 600 cp. Reasons prompting this decision were five in number—lower maintenance, lower energy cost per unit, higher power factor, increased illumination and increased station capacity.

The installation of series incandescent lamps will have the effect of a 19 per cent increase in constant-current transformer capacity. At this time about 175 arc lamps have been replaced by compensator fixtures and the reduced load on station constant-current transformers is noticeable. It has been necessary to readjust the four circuits affected.

In addition to the increased capacity, the services of one man at an average saving of $120 per month are dispensed with. It is estimated that the cost of making the change will be approximately $11.50 per lamp.

COMPARISON OF SERIES ARC LAMPS WITH COMPENSATOR-TYPE INCANDESCENT LAMPS

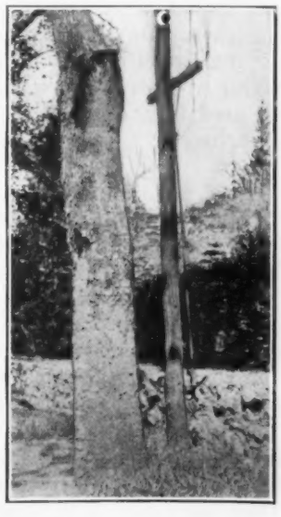
	7.5-Amp. Arc	20-Amp. Series Incandescent
Candlepower of unit 10 deg. below horizontal	325	1,280
Volt-amperes at station	819	434
Power factor	0.65	0.80
Kw.-hr. per year of 4,000 hours	2,128	1,396

It so happens that the company had about fifteen old inclosed lamp casings on hand. The auto-transformer employed was easily adapted for use with these casings. This was done by merely removing the arc-lamp mechanism and substituting the auto-transformer and adjustable socket to receive the 600-cp., 20-amp. incandescent lamp.

At the present time no change is being made in the globe or in the lamp shade, but it is intended in the near future to replace the old outer globes with either the Holophane prismatic-band refractor or the Holophane prismatic-bowl refractor. M. H. HUMMEL,
Superintendent Electric Department.

Augusta-Aiken Railway & Electric Corporation,
Augusta, Ga.

Inconspicuous Service Entrance for a Fine Residence



AN EXAMPLE of how inconspicuous a service entrance to a fine country estate can be made is shown in the accompanying photograph. The secondary leads are brought to a pole behind a tree near the front gate of the estate. From the pole top they are carried down the pole in a conduit and then in conduit through the wall and underground to the mansion. Neither the pole nor the conduit and wires are conspicuous from the road outside. This entrance is on the system of the Edison Electric Illuminating Company at Milton, Mass.

Industrial Applications

The Economical Utilization of Electrical Energy in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Records for Installed Industrial Equipment

IN INDUSTRIAL plants where a considerable amount of electrical equipment is installed the man who is responsible for its operation is at times called upon to give detailed data regarding certain pieces of equipment. With no record file, it becomes necessary for him to secure this information with considerable delay, and at times from apparatus that is in almost inaccessible places.

To meet such occasions the writer has devised a set of records of the equipment under his care. Herewith is reproduced a card which gives the shop number, location and class of service of an induction motor, together with the name-plate data, winding and repair parts data, its weight and the number of the switchboard panel to which the feeders are connected. Also the method of drive is recorded, including the size of the motor pulley. This might be carried a step further and considerable delay and annoyance when ordering repair parts from such records.

LEROY A. FRANCIS,
Chief Electrician.
Utica Steam & Mohawk Valley Cotton Company,
Utica, N. Y.

SHOP NO. 79 LOCATION No 2 Mill-3d Floor CLASS OF SERVICE Spinning

APPARATUS Induction Motor SERIAL NO. 1189465 RATING Type KT-346 B 50 900 Form B

H. P. 50 VOLTS 440 AMPS 61 SPEED 900/870 FREQUENCY 60 PHASE 3

MFGR. G E METHOD OF DRIVE Belt SIZE OF PULLEY 13" dia 12" face BORE

BRUSHES, CAT. NO. OR SIZE BLUE PRINT NO. M-1141985-part 1

WINDING DATA Stator 96 coils, Pitch 1-11, Gr 4, 2 ckt Y

REPAIR PARTS DATA Bearing linings, pulley end Cat #103151, front end Cat #61704 — stator coils Spec #306364 - Rotor winding, D W G - P 807506-1

FEEDERS CONNECTED TO SWITCHBOARD PANEL NO 19 WEIGHT 2750 lbs.

SWITCH DATA Start Comp CR1034 Type NR1630 Form H3P1 - Volts [Prim 440 Sec 176-220] For induction motor Type I, Form K, H.P. 50, Cycles 60, 3 ϕ MFGR G E

SWITCH REPAIR PARTS DATA Lower contact finger part Qa, Cat #129556 - Upper contact finger, part Pa, Cat #164335 - Lower contact segment, part Hb, Cat #129553 - Upper contact segment, part Jb, Cat #164334 (for additional parts see G E bulletin No 58304 B page 25)

REMARKS Relay panel Cat #320078 - Type P, Cyc - Amp 60 - Volts 600 - Ht 883 S2 For relay repair parts see G E bulletin No 58304 B page 17

For test data on motor see file T's page 7

Motor drives 18 Whiting spinning frames Total 2320 spindles

THIS RECORD MAKES IT EASY TO CHOOSE SPARE PARTS FOR REPLACEMENTS

The record is made out on a 3 by 5 card. On the face appear the shop number, location, class of service, name-plate data, winding data, repair parts data, weight and the number of the switchboard panel to which the feeders are connected. On the reverse side appear the switch data, together with the most important repair parts catalog numbers and letters. The number of the bulletin in which may be found the catalog numbers of additional repair parts which are less frequently used is also given as a means of saving time when it becomes necessary to look up these parts.

In this particular installation the motor is protected by means of an overload relay and the data for this, together with the number of the bulletins giving repair parts numbers and letters, have been recorded under the heading of "remarks." The winding data have been secured from the manufacturers of the various equipment and the information furnished by them, together with blueprints showing the coil connections, is kept in a file with repair parts bulletins, all of which are indexed for quick reference.

In gathering and compiling such information considerable care must be taken to avoid errors, as a record file full of errors is worse than none and will cause

Sixty-four Coils Reconnected from Series to Two-Parallel Star

CONNECTING sixty-four coils in a two-parallel star (three-phase) arrangement was necessary in a recent change of an induction motor from 440 to 220 volts. An odd arrangement of coils in groups was necessary to make this change. The motor was a 30-hp., 440-volt, 60-cycle, three-phase, eight-pole machine. As received the motor was connected series star with coils grouped as follows: 2-3-2, 3-2-3, 3-3-3, 2-3-2, 3-2-3, 3-3-3, 2-3-2, 3-(3—1)-3, there being one dead coil in the last group as indicated by (3—1 equals two coils). This made twenty-one coils per phase.

Now, to reconnect from 440 to 220 volts meant changing the connections to two-parallel star. As there were twenty-one coils per phase, there would be 21 ÷ 2 equals 10½, coils per parallel path. As one-half a coil is impossible, and ten coils in one leg and eleven in the other would not do, the only thing left would be to cut out three coils, one in each phase, or one coil out of every eighth pole-phase group containing three coils, or out of groups 8, 16 and 24. The resultant two-parallel grouping was as follows: 2-3-2, 3-2-3, 3-(2)-3, 2-3-2, 3-2-3, (2)-3-3, 2-3-2, 3-(2)-(2). In this notation the figures in parenthesis as (2) represent a group in which there is one dead coil. This makes four dead coils in the entire motor, which, however, was the best that could be done without rearranging the grouping, which meant removing all the stubs and jumpers, and losing the phase insulation in some places.

The motor was connected in two-parallel star and grouped as indicated and operated in a manner which proved satisfactory.

A. C. ROE.
Detroit, Mich.

Incorrectly Rated Pulleys Cause Machine to Be Driven Too Fast

TWO machines driven by motor through a line shaft were noticed recently to be running considerably faster than they should according to the rated speed of the motor and size of the pulleys. This was a shunt-wound, 230-volt motor rated at 1,150 r.p.m. The motor has a 4-in. pulley which is belted to a 24-in. pulley on the line shafting, and the 5-in. pulley on the line shafting is belted to a 13-in. pulley driving the machine. With the rated speed of the motor and this combination of pulleys, the machine should revolve at about 75 r.p.m. Upon investigation it was found that it revolved at about 88 r.p.m.

On checking the speed of the motor it was found to be 1,258 r.p.m., which was probably due to the motor running at a very light load and on a line having a potential of 242 volts. This, however, would not entirely account for the increased speed of the machine. Upon measuring the 4-in. pulley on the motor it was found to be $4\frac{1}{8}$ in. in diameter, the 5-in. pulley on the line shafting was $5\frac{1}{8}$ in. and the 13-in. pulley measured slightly under 13 in. All of these variations were sufficient to cause a change in the speed of from 75 r.p.m. to 87 r.p.m.

E. R. DEBMAN.

East Orange, N. J.

Voltage Readings on Large Battery Easily Taken by One Man

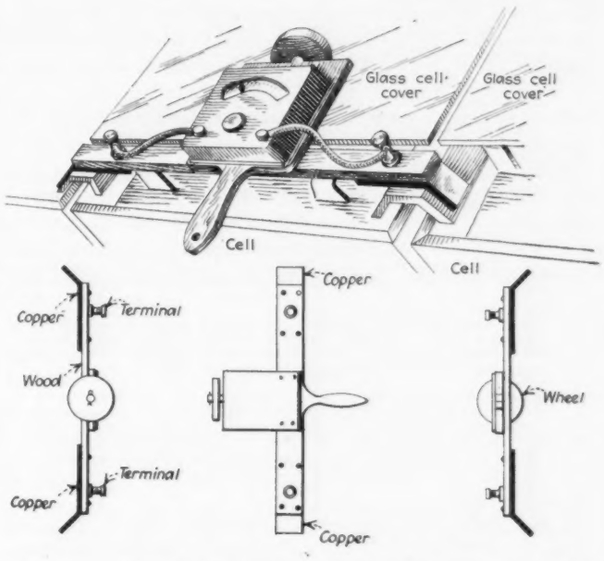
IN ORDER that voltage readings may be taken without trouble on the cells of a large stationary battery, a rolling holder with connecting contacts has been made by the writer. Taking voltage usually requires two men, one to carry the voltmeter and take the readings while the other marks them down. This device eliminates carrying the voltmeter on the arm and allows the man taking the readings to record them.

The meter rests upon a piece of $\frac{1}{2}$-in. board sawed with a scroll saw in the shape of a paddle as shown in the drawing. The square part accommodates a voltmeter while on one edge a small spur is left to act as an axle for a wooden or hard-rubber wheel 4 in. in diameter. On the opposite edge to the axle a handle is formed. Handle, axle and meter platform are all one piece of wood. Small beading is tacked around the edge of the meter board to keep the meter from sliding off. To the bottom of this board is fastened a strip of wood, 1 in. x 2 in. in size, cut long enough to span the outside edge of the cell which has the largest spread.

Two pieces of copper or brass sheeting, 1 in. x 6 in., are mounted on each end of the stick so that about 2 in. projects beyond the ends. These pieces are fastened on by the studs of two binding posts which are mounted on the opposite side of the strip. These binding posts are mounted far enough from the end of the stick to insure that their studs on the opposite side will not come in contact with the lead-cell connectors. The ends of the metal strips are bent downward at an angle of about 45 deg.

In operation the meter is laid on the board and the leads are fastened to the binding posts. Before taking readings the plate-glass cell covers should be moved back from the edge of the cells to expose at least an inch of the connectors. The contacts are placed on the edge of the lead connectors, while the wheel bears on the center of the plate-glass cell cover. When it is desired to move the meter to the next cell the handle is lifted with one hand until the contact pieces are clear, and then it is rolled over the plate-glass cover to the next cell.

It is advisable to remove all rough spots from the lead connectors where contact is made as well as to brighten the brass contact surface. This little conveyor when not in use is hung in the battery room by means of a hole drilled in the handle.



METER SUPPORT CAN BE ROLLED OVER TOPS OF CELLS WITH EASE

Tuckahoe, N. Y. JOHN E. MCCARTHY.

Selecting Varnish and Applying It to Motors and Coils

APPLICATION of varnish to armatures, armature coils and field coils is an art which depends on the preliminary treatment of the objects to be varnished, the proper selection of varnish and its proper application. As a guide in the selection of varnishes and their application the tables shown herewith will prove useful. Table II shows the varnishes most suitable for different classes of work. If the motor to be repaired is to operate under exceptional conditions, such as high temperature or dampness, Table III should be consulted to see what varnishes are suitable for these conditions. In Table I are found descriptions of the different types of varnish and instructions on how to apply them, time required for drying and the material used for thinning. Table II may specify several varnishes that can be used for a certain job, but reading the descriptions in Table I will usually allow a decision as to the best one.

In many shops too little attention is paid to preliminaries. It is well known that the cotton covering of wire, cotton tape and fibrous materials which go into the construction of coils readily absorb moisture, in many cases up to 10 per cent of their weight. This moisture must be driven out before the varnish is applied. This is done by subjecting coils to prebaking at a temperature above the boiling point of water for periods of one hour or longer, depending upon the size of coils and depth of windings. Prebaking is of value in other ways. The copper becomes uniformly heated,

TABLE I—CHARACTERISTICS OF VARNISHES USED IN MOTOR-REPAIR WORK

Kind of Varnish	How Applied	Baking Temperature, Deg. C.	Time to Dry or Bake	Thinner
1. Clear air-drying varnish: A clear oil-base varnish for all types of field and armature coils. It possesses high dielectric strength, is not affected by moisture, and is proof against the action of lubricating oils. Intended particularly for use when it is not convenient to dry by artificial heat. Good for high-tension machines.	Dip or brush	.....	8 hours	Benzine
2. Black baking coil varnish: For all types of coils. It has high dielectric strength and is water-repelling. It is particularly recommended for stationary motors and generators, where plastic properties are often necessary or desirable.	Dip or brush	100	3–6 hours	Benzine
3. Black plastic baking varnish: Recommended for armature and field coils of direct-current motors which operate in damp surroundings. It is waterproof and oil-resisting and retains its plastic properties indefinitely.	Dip or brush	100	8 hours	Benzine
4. Clear baking coil varnish: A clear oil-base varnish intended for the insulation of high-tension and low-tension coils where maximum elasticity is required. The insulation is high and uniform, and the varnish coating is moisture-resisting and impervious to lubricating oils.	Dip or brush	100 120	6–8 hours 4–6 hours	Benzine
5. Black elastic baking varnish: Made with China-wood oil and a black water-repellent gum base. Recommended for use on armature and field coils of all types of direct-current motors. On account of water-resisting properties, it is recommended for electric railway motors. It produces a strong, glossy black film impervious to lubricating oils.	Dip or brush	100	6–8 hours	Benzine
6. Clear heat-melted varnish: A solventless, clear varnish which is liquefied by heat. Recommended for use on armature, field, lifting-magnet, high-potential and other coils. It is very flexible, plastic and an excellent insulator. It has no injurious effect on either red or black-enameled wire. It is absolutely waterproof and fiber and paper may be moisture-proofed by treating in this liquid at 110 deg. C. and baking.	Dip or vacuum impregnation at 140 deg. C.	100	4 hours	None
7. Clear baking varnish: A light-colored, very flexible insulating varnish for use on coils where the maximum flexibility is desired. An excellent dielectric with a breakdown exceeding 1,250 volts per mil. Oilproof and waterproof. Recommended for high-tension work.	Dip or brush	100	4–6 hours	Benzine
8. Clear baking varnish: A light-brown flexible and adhesive insulating varnish suitable for form-wound coils, taped or untaped, braided or enameled. Very adhesive. Oilproof and waterproof. Recommended particularly for all one-coat work on armatures and fields.	Dip or brush	100	6–8 hours	Benzine
9. Clear baking varnish: A golden-brown insulating varnish: produces an amber finish. It is very viscous and produces a smooth, hard, elastic and flexible film which is not easily abraided. It penetrates and fills the coils completely and dries internally. Recommended for all types of coils, armatures and stators. Form-wound coils treated with this varnish can be assembled after months of aging without damaging the insulating film. For apparatus subjected to wide ranges of temperature, severe vibration or operated in moist, oily or dusty places.	Dip or brush	100 120	6 hours 3 hours	Benzine
10. Black waterproof compound: A solid compound for impregnating in vacuum, fields, small armatures, etc. It is recommended particularly for the electric railroad and tramway, motor-field coils and air-compressor coils. It liquefies readily within safe temperature limits. It has high insulating properties, is water-repelling and possesses good heat-conducting properties. This last feature makes it particularly desirable for use in the impregnation of fields where there is abnormal temperature rise due to severe operating conditions.	Vacuum impregnating	Dipping point 100	Hardens on cooling	Blender to control dipping point
11. Black air-drying coil varnish: A black insulating varnish composed of hydro-carbons, recommended for the insulation of coils subjected to wide range in temperature, and is particularly desirable for use on armature and field coils of all types of direct-current motors. The drying of this varnish is effected solely through the evaporation of its solvents. It has high insulating properties and is moisture-resisting and water-repellent.	Dip or brush	.....	2–4 hours	Benzine
12. Black finishing varnish: A black glossy finishing varnish for use as a last coat over armatures and field coils. It is water-repellent and a good insulator. This varnish is recommended for use in shops of manufacturers of dyanmos and motors, and particularly in the repair shops of electric railroads and tramways. It reinsulates and provides a waterproof covering, which will not become brittle nor scale off. Is acid-proof and alkali-proof.	Brush	.....	30 min.	Benzine
13. Black alcohol-base varnish: A black oilproof alcohol finishing varnish for dipping or painting armatures and fields to protect them from lubricating oils. Is absolutely oilproof and gives a bright, glossy finish, which will not fade. This is a quick, air-drying, alcohol-solvent varnish which combines elasticity with oilproof properties.	Brush, after removing dirt with benzine rag	.....	20 min. to 30 min. Time reduced by heating	Denatured alcohol
14. Clear spirit varnish: A clear oilproof finishing varnish for armature and field coils. Dries with a hard, glossy finish, which is oilproof.	Brush	.....	30 min.	Denatured alcohol
15. Black coreplate varnish: This air-drying varnish is specially prepared for coating armature disks or laminations.	Dip, brush or coating machine	.....	10 min. Time reduced by heating	Benzine
16. Black frame paint: Pigment paint with a special iron oxide filler	Brush	.....	.....	.....

expanding the air in the coil, and the varnish, when applied quickly, penetrates to the inner layers of the winding. It has also been found that prebaking shortens the regular baking period. The latent heat of the coil tends to assist in the quick expulsion of solvent, and rapid and thorough oxidation of the varnish base.

Coils subjected to the preliminary treatment described are in a state to absorb quickly varnish to their full capacity. They should be taken from the oven and immediately submerged in the varnish. If the baking oven is heated by gas, the tank of varnish should be situated a suitable distance away so that all danger will be minimized. As the hot coils are submerged there will be a slight volatilization of the solvent. This solvent should be replaced when varnish is again used and proper dipping gravity checked by hydrometer.

The time of submergence depends upon the type and size of coil, the size of wire and the depth of winding. A few minutes usually is all that is required. A safe

guide is the appearance of the varnish surface. As the varnish penetrates the winding, driving out the air, it causes bubbles to appear. When bubbles cease to come up it is safe to assume that the coil is well filled.

Coils are then taken from the varnish and hung up to drip. Usually fifteen minutes is sufficient and they should then be placed in the oven to bake. Field and magnet coils should be baked for one-half to one hour at a temperature not exceeding 71 deg. C. (160 deg. F.) after which the temperature is raised. The reason for this is that subjecting deep windings at once to the maximum baking temperature usually results in forming an oxidized film over the surface of the coil, which tends to seal in a portion of the solvent. This lengthens the drying time and in many cases proves injurious either through reducing the insulation or affecting the enamel (if wound with enamel wire), or both. The low temperature used for the prebaking period allows the solvent to escape quickly from the interior of the coil. It is not often necessary to subject armature coils to preliminary baking. The winding is usually shallow and the solvent is driven out at the high baking temperature before an oxidized coating is formed on the surface.

TABLE II—VARNISHES TO USE FOR DIFFERENT PURPOSES IN REPAIRING MOTORS

Part to Be Varnished	Varnish to Use (Numbers Refer to Table I)
Coils, form-wound:	
Air-drying varnish	1, 11
Baking	2, 3, 4, 5, 7, 8, 9
Coils, field:	
Air-drying varnish	1, 11
Baking	2, 3, 5, 6
Impregnating in vacuum	10
Finishing	12, 13, 14
Armatures:	
Baking	5, 8, 9
Finishing	12, 13, 14
Stators:	
Baking	5, 9
Laminations	15
Frame, inside	12
Frame, outside	16

TABLE III—VARNISHES TO USE ON MOTORS AND COILS WHICH OPERATE UNDER EXCEPTIONALLY BAD CONDITIONS

Special Quality Desired	Varnish to Use (Numbers Refer to Table I)
Adhesive	9, 8, 5
Plastic	2, 3, 6, 11
Damp-proof	3, 5, 9, 12
Oil-proof	13, 5, 9, 14
Acid-proof and alkali-proof	12
High-temperature-resisting	10, 6
Wide temperature range	11, 9
High insulating properties	1, 7

After the preliminary baking the temperature is raised to maximum and continued till the varnish is dried thoroughly. The baking time and temperature are governed by the type and viscosity of the varnish. Elastic or long-oil varnishes are not injured by high temperatures. In fact, a temperature of 115 deg. C. (240 deg. F.) gives best results. It is high enough to oxidize the varnish within the minimum time and not too high to injure the cotton, paper or fiber. Long-oil varnishes are now obtainable which will bake on armature coils in four to five hours. Not so long ago a varnish was not considered elastic if it required less than twelve hours to bake. This shortening of time without loss of elasticity has been brought about by the use of china-wood oil combinations and improved methods of manufacture.

Multiplicity of varnish coatings has solved many insulating problems, and the custom now followed is to give all coils at least two and up to twelve brushed or dipped coatings. In such cases the varnish is applied at reduced gravity by the addition of 20 per cent to 30 per cent of thinner—usually benzine. When one coat is applied varnish should be used at full body.

With small armatures wound with enameled wire and operating at high speed (4,000 r.p.m. to 12,000 r.p.m.) special attention must be observed in winding, balancing and applying and baking successive varnish coatings and in providing for the separation of conductors which do not run parallel.

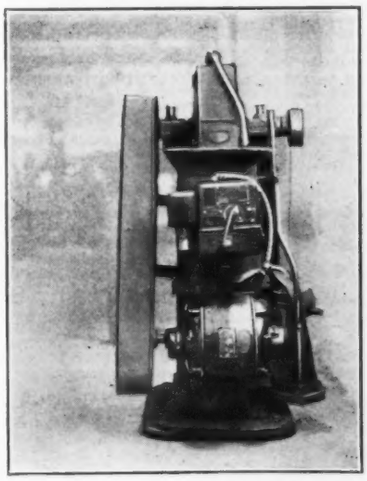
An approved specification for varnish coils is given in the following:

1. Preheat coils at 110 deg. C. (230 deg. F.).
2. Submerge in varnish at reduced consistency for five to ten minutes, or until bubbles cease to appear on surface.
3. Remove coils from varnish and hang up to drip for ten to fifteen minutes.
4. Place coils in oven. If armature coils, the maximum temperature may be applied at once. If deep windings, prebake at low temperature before applying the maximum.
5. Armature coils should be dipped twice and each coat thoroughly dried. The first coat is applied with leads down, the second coat with leads up. The second dipping with leads up insures the proper filling of the space at the joints where the lead leaves the coil, thus preventing the entrance of moisture at this weak point.

The value of this system of insulating coils is apparent. The coating is smooth and uniform, and by "breaking joints" a perfect high dielectric covering is insured.

JOHN C. DOLPH,
John C. Dolph Company, President.
Newark, N. J.

Mounting a Motor Directly on a Grindstone Frame



FORMERLY DRIVEN BY OVERHEAD BELT

A METHOD of adapting individual drive to a grindstone formerly driven from a group shaft is shown in the accompanying photograph. The motor is bolted to straps attached to the pedestal near the floor level. The starting switch directly above the motor can be reached without stooping and a short run of flexible armored conductor makes connection between the switch and the motor. The metal belt guard at the left is strapped to the pedestal to prevent injury to the operator. This arrangement is economical of space and investment. Mounting the motor above the floor allows the floor to be cleaned and swept without inconvenience.

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Malicious Breakage of Insulators Reduced by Educating Children

THE number of transmission-line insulators broken maliciously in the Willamette Valley division of the Portland (Ore.) Railway, Light & Power Company has been reduced almost to zero as a result of a campaign of education conducted among the school children of the territory. It was found that insulators were frequently broken by the children throwing stones or shooting at them and that even adults thoughtlessly did the same things without realizing the seriousness of their action. To correct this the local manager of the company, accompanied by the school superintendent, visited each of the schools and addressed the children upon the danger caused by broken insulators.

In addition each child received the letter reproduced here, which was to be taken home and read by the parents. The letters each carried a statement to be signed by the parent, detached and returned by the child to his teacher. These were later collected by the company. The teachers understood the value of the work and gave great assistance in getting the slips signed and returned. One point in getting the attention of the children was the exhibition of insulators which had been broken by stones, causing electrical failure.

W. M. HAMILTON,
Manager Willamette Division,
Portland Railway, Light & Power Company,
Salem, Ore.

PORTLAND RAILWAY, LIGHT & POWER COMPANY,
WILLAMETTE VALLEY DIVISION,
SALEM, ORE.

MARCH 7, 1921.

TO PUBLIC-SPIRITED CITIZENS:

Lives and property are being endangered by insulators on the electric power transmission line in your vicinity being broken by mischievous or thoughtless persons who shoot or throw rocks at them.

An insulator may be merely cracked by being struck by a bullet or stone and only allow a small current of electricity to leak through to the cross-arm at first. This leak will increase as time goes on until it suddenly becomes a short circuit and blows the insulator to pieces, and frequently burns the wire in two and allows the burning ends to drop to the ground.

These wires carry 57,000 volts of electricity, whereas house-lighting wires carry only 120 volts. As 500 volts will kill a person, everything possible should be done to prevent electric power transmission-line insulators from being broken or cracked.

Even if no lives are lost by an insulator being broken, think of the inconvenience that the users of electricity experience when the power "goes off," which happens when an insulator is blown to pieces by a short circuit.

If it happens at night, people are left in darkness in theaters, stores and homes. A doctor may be operating on some one and is suddenly plunged into darkness and cannot go on with the operation until other light can be had. Think of the possible consequences! Dishonest persons may steal valuable things out of the stores they are in. Water pumps, refrigerating plants and other machinery that is driven by electric motors cannot run. As a result buildings may burn down for lack of water, meat may spoil in refrigerating plants, and, at least, a lot of time is lost by workmen in shops and plants that cannot run because the "power is off" until the broken insulator can be found and replaced.

We therefore urge you to spread this information regarding the result of cracked insulators as much as possible and do all in your power to prevent people from shooting or throwing stones at them.

If you cannot get some people to stop doing it, please give us their names and addresses and we will take the matter up with them ourselves and *compel* them to stop, if necessary.

You will also be of great service to the public if you will notify us at once by telephone of any "fireworks" on our line, which always indicates a short circuit. This will help us locate the trouble and get the repairs made as soon as possible.

We ask that you sign and return the attached slip so that we may know, as a matter of interest only, the extent to which this letter has been read and how much assistance we may expect from those to whom it has been sent. Yours truly,

PORTLAND RAILWAY, LIGHT & POWER COMPANY.
W. M. HAMILTON, *Division Manager.*

'Phones: Salem—55, 242. Silverton—Black 1121, Main 301.

Portland Railway, Light & Power Company,
Salem, Ore.

GENTLEMEN: I have read your letter of March 7, 1921, regarding broken insulators and will do what I can to prevent them from being broken in the future.

R.R. No.....Box No.....

Name.....

P. O. Address.....

WIDE CIRCULATION OF THESE LETTERS REDUCED BREAKAGE OF INSULATORS TO MINIMUM

Meeting the Public in the Commercial Office

AS A RESULT of the efforts to remove the prejudice against utility corporations from the minds of consumers there is evidence of greater progress than has been made at any time during the last two decades, John H. Ghegan of the Kings County Lighting Company asserted in a paper presented before the commercial section of the Empire State Gas and Electric Association. It is, he said, incumbent upon public utilities to take advantage of the popular trend of thought in order to remove to a large extent the well-established distrust, doubt and antagonism against corporations. Mr. Ghegan continued:

"When public service corporations are putting forth every effort to gain the good will of the public, educating them in public utility problems and endeavoring to interest them to the extent of investing their savings in stocks of these corporations, it is most important that every consideration be given to the consumer who finds his way to the company's office, no matter what the purpose of his visit may be. He has called for a specific purpose and is entitled to the courtesy and consideration that would be extended to him if he were to visit the establishment of any merchant. There he knows he would be welcome.

WHO SHOULD MEET THE CUSTOMER?

"The questions arise: Who shall meet the consumer? Who shall represent the company? The impression given by one who receives the visitor reflects the whole policy of the company in its relation to the community it serves. How necessary, then, that the first impression be one that will convey evidence of good intention, good will and a desire to please—an impression that will

at once put the visitor at ease and one that will immediately establish the first step toward friendly relations.

"The spirit of complaint is contagious, and if the office arrangement is such that criticisms made by a consumer are overheard by others who at first had no idea of calling at the office of the utility to give expression to dissatisfaction, it invariably will be found that complaints will be registered by persons who entered the office with no idea whatever of making them. In our company an office has been set apart for the reception of the visitor who feels that he has a grievance against the company. A man whose experience and characteristics qualified him for the position was selected to take charge of this office and received the title of 'adjuster.'

PRIVATE OFFICE BEST FOR ADJUSTING COMPLAINTS

"The plan of bringing the caller into a private office, putting him at ease and honestly inquiring as to the cause of his visit had a very good effect. The customer who had called expecting curt attention and small consideration found to his surprise that he was not going to be treated in that manner and immediately became more reasonable and uttered his protest in a quiet, businesslike way. The matter could then be easily adjusted because the visitor had been brought to a receptive frame of mind, and when the case was settled he would leave well pleased with the interview and with an entirely different opinion of the company.

"In the matter of complaints about bills a system was devised whereby a complete record of a consumer's complaint is made from the time of its reception to its final disposition, giving all information gathered by the inspector, who on his visit to the consumer's premises carefully examined the entire installation, endeavoring in every way to leave the consumer satisfied before completing his inspection. This information is forwarded in a general report to the consumer, accompanied by a card showing him how to read the meter. This little card has done wonders in keeping down complaints, particularly where errors occurred in reading or where bills were for a longer period than the usual monthly term.

POOR SERVICE AND ACCOUNTING ERRORS MUST HAVE PERSONAL ATTENTION

"Other complaints of poor service and bookkeeping errors and the many other reasonable and unreasonable complaints received by the company are all handled by the adjuster's office, and in no case is the consumer allowed to feel that his complaint has not been carefully looked into. Whenever the case demands it proper adjustment is made promptly. Whenever it is found the fault lies with the company a letter of regret is immediately sent to the consumer. This personal contact with an employee who shows a desire to aid the consumer and who feels it his duty to place service above everything else is bound to create a good and lasting impression upon the visitor which in time will redound to the benefit of the company. The dissatisfied customer of today, properly handled, becomes the friend of tomorrow.

"The visit of a consumer to the company's office affords an excellent opportunity for the company to state its position directly to the user of its product. It is an opportunity to present its problems and to impress upon the mind of the caller the fact that the company realizes the full value of the public's good will and is at all times trying to gain this most valuable asset. The public is gradually becoming friendly to the public utility companies owing to the publicity given our problems, and to my mind one of the easiest and best ways of reaching the people is by inviting co-operation and by square dealing and courteous treatment restoring public confidence, and so gradually ridding the public mind of the antagonism which so long has been a barrier to progress.

"A capable man in the office can be a very important factor in establishing this result. It is absolutely necessary that the consumer should be met by one who is conversant with the affairs of the company, its policy, its problems and system, in order for him properly to enlighten the consumer and at the same time grasp the opportunity of educating him on those matters upon which he is not informed. To do this satisfactorily to all concerned requires more than the efforts of an office boy or a minor clerk. The adjuster himself must know his work; he must be a student of human nature; he must observe the golden rule, placing himself in the position of the complainant, and last but not least he must be endowed with an unlimited amount of patience."

Northwestern Electric Now Selling Preferred Stock Locally

THE Northwestern Electric Company, Portland, Ore., is beginning an active campaign in its territory to place $1,000,000 of 7 per cent cumulative first preferred stock. It is to be sold at 95, to yield approximately 7⅜ per cent. The original 6 per cent preferred stock, of which there is $1,870,300 outstanding, is convertible into this issue at the rate of one share of the original for nine-tenths of a share of first preferred. The proceeds are to be used for extensions and additions to take care of new business. Consideration is also being given to the construction of an 8,000-hp. hydro-electric station below the company's present station on the White Salmon River. This will be the first attempt of this company to place its securities directly and with its own consumers.

Central Maine Employees Sell Nearly 5,000 Shares of Preferred Stock

IN SEVEN contests for the sale of Central Maine Power Company preferred stock by employees, 4,967 shares were disposed of, according to an announcement in the *Exciter*, the company's official organ. Most of the work has been done within the past two years. The number of employees interested and the number of shares sold have increased rapidly with each advancing contest. In the first contest seventy-one employees participated and sold 277 shares, whereas in the seventh and latest competition 113 employees sold 1,103 shares. The largest single sale in any contest was 200 shares, and the prizes and commissions awarded in the last three contests reached a total of $6,253.25. In the last seven years more than $5,000,000 has been expended in new construction on the Central Maine system, and the number of customers served has been nearly doubled. The activity of employees has been most helpful in the development of the customer-ownership idea throughout the company's territory.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Diesel Engines for Generator Driving.—C. S. DARLING.—The points in the operation of the Diesel engine which should be watched carefully to prevent trouble are described in this paper. It states that the temperatures of inlet and outlet water from the cylinder jacket and the temperatures of exhausts should be always watched. The color of the exhaust flame and the presence of smoke should be noted. An analysis of the various troubles causing smoke shows that smoke of different colors is due to different defects. A table showing a typical test run of a 300-kw. engine is given. —*Beama* (British Electrical and Allied Manufacturers' Association), July, 1921.

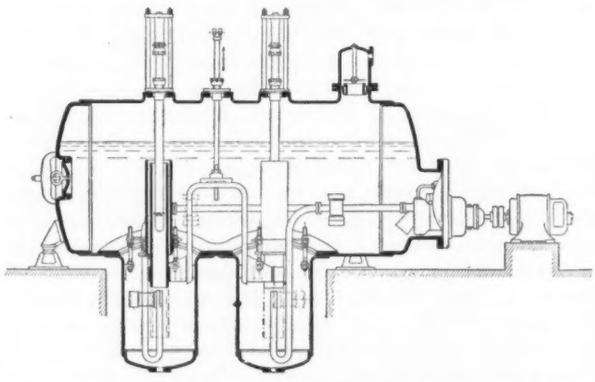
Generation, Transmission and Distribution

Surge Protection on Transmission Lines.—S. CUNHA and G. C. READ.—Discussion of problems with special reference to the method of surge protection used by the Montreal Light & Power Consolidated of Canada.—*Journal of Engineering Institute of Canada,* June, 1921.

Zillingsdorf Lignite Power Plant for the Supply of Vienna—II.—R. BERON.—The 38-km. transmission line consists of two 70,000-volt, three-phase lines of 50-sq.mm. copper strands supported on 20-m. steel towers, spaced 150 m. apart in the open and 60 m. near inhabited places. Four-disk and five-disk insulator chains are used. Above the power lines a galvanized 60-sq.mm. steel cable is fastened to the top of the poles to act as a lightning arrester. To avoid inductive disturbances the lines are transposed twelve times. The telephone wires are carried on separate poles, following a different route. During the year 1920 energy amounting to over 60,000,000 kw.-hr. was transmitted to Vienna, which helped very materially to overcome the coal shortage. The total equipment of the plant comprises at present a coal conveyor plant capable of handling 40 tons per hour, twelve boilers of 500-sq.mm. heating surface each, a set of twelve pressure and twelve suction fans for forced draft, a feed-water cleaning plant handling 20 cu.m. per hour, four turbo-generators of 8,000 hp. each, two turbo-generators of 12,000 hp. each, a 40-ton crane, two 8,500-kva. transformers rated at 5,000-35,000/70,000 volts, one 20,000-kva. transformer rated at 5,000-35,000/70,000 volts, one 3,000-kva. transformer rated at 16,000 volts.—*Elektrotechnik und Maschinenbau,* June 12, 1921.

Production of Power from Internal-Combustion Engines.—F. W. BURSTALL.—An economic comparison of gas engines and crude-oil engines, including capital costs, to be used as a basis for the selection of driving engines for electrical generation.—London *Electrician,* June 24, 1921.

The Electric Steam Boiler.—J. BUCHLI.—The electrically heated boiler can compete with a steam-heated boiler only if the electrically produced heat unit does not cost more than one has to pay for a heat unit derived directly from the usual solid or liquid fuels. This will permit in general the use of hydro-electric power only. Equipped with a steam accumulation chamber, for which any existing steam boiler may be used after some small changes, the electro-boiler is eminently suited to fill in the off-peak valleys of any generating station. This is of great importance for factories with their own hydro-electric plant. Another ideal use for the electro-boiler may be found on alternating-current railways in heating the train. Of three different types of boilers—the resistance, the arc and the induction type—only the first has found practical use. If the boiler is small and the feeding voltage below 1,000, resistance grids are placed within the boiler. For higher voltages, up to 20,000, the water itself represents the resistance between the steel wall of the boiler and one or more electrodes. Only



ELECTRICALLY HEATED STEAM BOILER USED IN HEATING CARS OF THE SWISS FEDERAL RAILWAYS

alternating current can be used for the latter, to avoid the decomposition of the water into the highly explosive mixture of H_2 and O. Extensive tests made on large electro-boilers with alternating current of the lowest practically used frequency, *i.e.*, 16⅔ cycles, showed that there is no danger from any possible gas generation, and this possibility is, of course, still more remote with higher frequencies. The regulation of the current in relation to the steam demand may be effected either by controlling the depth of immersion of the electrodes in the water or by changing the position of an insulating cylinder placed coaxially with the electrode, and thereby increasing or decreasing the length of the path of the current through the water. The latter method has been highly developed by the Brown-Boveri company. For the automatic maintenance of a constant steam pressure the insulating cylinder may be connected to a float. The insulating cylinder may consist of earthenware for low voltage or of porcelain for high voltage. With large-output boilers only quartz will resist. To provide the necessary cooling of the

electrodes in large-output boilers a water-circulating pump is provided. One of the great advantages of the electro-boiler, it is said, is that boiler scale does not form in it. The article contains many sectional drawings of electro-boilers, a photo of a 15,000-volt train-heating boiler and details of thirty-four existing plants up to 2,250 kw.—*Brown-Boveri Mitteilungen*, March-April, 1921.

Lamps and Lighting

Line Loss of Street-Lighting Circuits.—H. E. BUTLER.—An analysis of the losses in No. 6 and No. 8 wire and the per cent relation to lamp wattage, with a discussion of the factors that should be taken into consideration in deciding upon the proper size of conductors to be used.—*General Electric Review*, August, 1921.

Future Field of Illuminating Engineering.—J. H. ASDELL.—Lighting, according to this paper, can be considered perfect only (1) when obtained in a manner not injurious to the eye, (2) when the units harmonize with the surroundings and do their share in presenting the desired artistic or architectural effect, and (3) when mental appreciation is caused by the impression on the brain. Simultaneously the efficiency should be as high as possible consistently with these results both from the installation and the maintenance point of view. A discussion follows showing how these results can be obtained, and special explanation is given of the effect of various colors.—*Beama* (British Electrical and Allied Manufacturers' Association), July, 1921.

Traction

Battery Locomotives.—JAMES DALZIEL.—Gives operating characteristics for storage-battery shop locomotives.—London *Electric Vehicle*, July, 1921.

Results of Automatic Substation Operation on Chicago, North Shore & Milwaukee Railroad.—CHARLES H. JONES.—The service performed by the Chicago, North Shore & Milwaukee Railroad is of a heavy interurban character comparable to that given by many interurban steam lines. The demands on the substations are said to be exacting and the success of the six automatic substations is significant. Thoroughgoing methods for the inspection and maintenance of these substations are described. The system of inspection is outlined, and the paper also includes general statistics as to the amount of traffic and power consumption as well as data on the operation of the automatic equipments.—*General Electric Review*, July, 1921.

Electrification of the French Railways.—Various methods of heavy electrification are discussed to determine which is most satisfactory for France, with the conclusion that all three (three-phase, single-phase and direct-current) systems should be tried.—London *Electrician*, July 1, 1921.

Installations, Systems and Appliances

Accumulators or Secondary Batteries.—A history and a description of storage batteries of various types are given, including interesting details of manufacture.—*Beama* (British Electrical and Allied Manufacturers' Association), July, 1921.

Draft Tubes for Hydro-Electric Plants.—E. VOETSCH.—A discussion of various types of draft tubes and a comparison of their efficiencies.—*Power*, Aug. 2, 1921.

Electric Furnace Heat Treatment.—E. F. COLLINS.—Abstract of paper before the American Drop Forge Association which considers heat-treating furnaces under two heads: (1) When used with dies and metal-cutting tools, and (2) when used with drop forgings. The author shows that in a large furnace the cost per pound of heating steel is 0.199 cent for electricity, or if oil is used 0.317 cent for fuel.—*Iron Age*, Aug. 4, 1921.

Electrophysics and Magnetism

Arc Rupture of Liquid Dielectrics.—C. J. RODMAN.—Non-inflammable or semi-inflammable liquids of comparatively high dielectric strength and which may act as a medium of low viscosity were subjected to high-frequency arcing beneath the liquid surface. The liquid dielectrics are apparently broken down by a temperature pressure of very short duration, rather than by the sympathetic vibration and rearrangement of the compounds by high frequency alone.—*Journal Franklin Institute*, July, 1921.

Calculation of Direct-Current Electromagnets.—E. GABOR.—Electromagnets, especially those used in railway signal work, have to conform to a great number of most exacting requirements. They have to operate, for example, with a certain minimum amount of torque to actuate safely the particular device, regardless of considerably varying voltage. Methods and formulas for the design of magnets for such service with the least amount of copper and bulk are given in this interesting paper, dealing with the best shape of the coil, the torque, the location of the fulcrum of the armature for maximum torque, and the influence of the size and shape of the pole piece upon the magnetic pull.—*Bulletin de l'Association Suisse des Electriciens*, January, 1921.

Electrochemistry and Batteries

Thermal, Electrical and Magnetic Properties of Alloys.—ALPHEUS W. SMITH.—Results and generalization for numerous alloys grouped according to their solubility in each other.—*Journal Franklin Institute*, July, 1921.

Electric Reduction of Iron Ores.—H. A. DE FRIES.—A discussion of the comparative costs of the shaft type and pit type electric furnaces and of the adaptability of these furnaces to local conditions.—*Chemical and Metallurgical Engineering*, Aug. 3, 1921.

Precipitation of Suspended Particles in Gases.—A description of the use in a number of industrial plants of the Cottrell process for precipitation.—*Electrical Review*, July 30, 1921.

Telegraphy, Telephony and Signals

Oscillations in Three Coupled Electric Circuits.—L. C. JACKSON.—Development of mathematical theory of oscillations in three coupled electric circuits, in which the equation is obtained and then solved for certain special cases.—*Philosophical Magazine*, July, 1921.

A Survey of Radio Telephony.—R. L. SMITH-ROSE.—In this survey the high-frequency alternator, radio telephony for aircraft, the choke-coil method of valve modulation and duplex radio telephony are treated. A description of an ingenious arrangement devised by Alexanderson for effecting modulation for maintaining the load on the high-frequency alternator is discussed. Diagrams for valve connections are given.—*Beama* (British Electrical and Allied Manufacturers' Association), July, 1921.

Scientific and Industrial Research

(PRINTED IN THE THIRD ISSUE OF EACH MONTH)

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available, and Suggestions for Co-operative Work.

Conducted by PROF. VLADIMIR KARAPETOFF
Cornell University, Ithaca, N. Y.

Research in Progress and Completed

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

HUMAN BODY, ELECTRICAL RESISTANCE OF.

Use was made of four connections to the body. Two of these constituted a pair of current terminals, and the other two a pair of potential terminals. In order to obviate disturbing effects at the electrodes, an alternating current and a detector which responded to alternating current only were used. Very little current was taken through the potential connections. Using the left hand and the left foot as current terminals and the right hand and right foot as potential terminals, the resistance of the trunk was found to be on the average about 26 ohms.—*Bureau of Standards, Washington, D. C.*

WELDING, ARC, EXPERIMENTAL STEEL BOX.

A box, 12 ft. x 10 ft. x 9 ft. (3.6 m. x 3 m. x 2.7 m.), was made of ¼-in. (1.25-cm.) tank steel, using eleven different varieties of welds. The welding was done with 75-volt direct current. The principal objects to be ascertained in the construction of this box were: (1) Could a structure of this character be made close to drawing dimensions and without excessive distortions and warping of plates and parts? (2) Would the structure be strong and capable of withstanding severe shocks and distortions without serious ruptures? (3) What are the detail costs and time required to build such a structure? For a detailed account of tests on this box see *A. I. E. E. Proceedings*, April, 1919, page 608.—*R. E. Wagner, Pittsfield, Mass.*

BELT TESTING BY ELECTRICAL MEANS.

A series of tests on leather belting is being carried on, and it has been found that electrical machinery affords the most convenient and satisfactory apparatus for power transmission tests. The principal advantage is due to the saving obtained by absorbing the power transmitted and returning it to the driving motor. Two electric dynamometers are used, one driving the other through the test belt, with the losses supplied by a separate generator. Because of having two dynamometers, instead of a dynamometer and an ordinary motor, the belt can be run in either direction, with the tight side above or below.—*R. F. Jones, Cornell University, Ithaca, N. Y.*

[This is an extensive series of tests carried on under the auspices of the Leather Belting Exchange Corporation, an association of belting manufacturers.—EDITORS.]

ALLOYS, NICKEL-IRON, PHYSICAL PROPERTIES OF.

A graded series of alloys were studied with nickel content varying from 1 to 90 per cent. The specific heats were determined by a Joly calorimeter and the thermal conductivity by the Gray method. The thermoelectric powers relative to pure copper and the electrical resistance as a function of temperature were determined by use of a potentiometer. For a complete report and curves of the results see the *Physical Review*, Vol. 16 (1920), page 126.—*L. R. Ingersoll, University of Wisconsin, Madison.*

SPRINGS, SEASONAL BREAKAGE OF.

It is a very common belief among jewelers that after thunder showers they must be prepared to replace an unusual number of mainsprings. This they ascribe to the effect of electricity in lightning. A study of some records which jewelers keep of their repairs was made and a very pronounced effect was found. The seasonal breakage is not, however, due to electricity or magnetism, but to moisture which starts rust in minute spots, either on the surface of the spring or in minute cracks, causing the skin of the steel to be weakened and the springs to let go. Oil on the surface of the springs prevents breakage when the springs are placed in a moist atmosphere.—*S. R. Williams, Oberlin, Ohio.*

ALUMINUM SOLDERS, TESTS ON.

A series of tests has been made on aluminum solders. In spite of the claims made by those interested, no solder for aluminum has yet been found which will withstand the corrosion tests, although fused zinc-chloride solders withstand corrosion for the greatest length of time.—*Bureau of Standards, Washington, D. C.*

TUNGSTEN, SPECIFIC HEAT OF.

A. G. Worthing of Nela Park Research Laboratory and the writer have made a study of the specific heat of tungsten at incandescent temperatures to see whether the atomic heat approached the theoretical value predicted by several physicists. It has been felt that with some changes in the method more accurate data would be obtained. (See *Physical Review*, August and November, 1918.) The specific heat of a filament is obtained from measurements with a variable current, and different results have been obtained for increasing currents from those reached with decreasing currents. Further research is under way to find more refined methods of measurement.—*P. F. Gaehr, Wells College, Aurora, N. Y.*

[Two money grants have been given in aid of this study, one by the American Association for the Advancement of Science and the other by the American Academy of Science.—EDITORS.]

STEEL, CORRELATION OF MAGNETIC AND PHYSICAL PROPERTIES OF.

A study is being made of the possible relations between the physical and magnetic properties of various kinds of steel, including the possibility of detecting imperfection of structure. A precision permeameter is used in the measurements.—*W. B. Kouwenhoven, Johns Hopkins University, Baltimore, Md.*

TELEPHONE RECEIVERS, RADIO, HIGH-FREQUENCY, IMPEDANCE OF.

The input impedance of an electron-tube detector, and thus the intensity of signals received, depends among other things upon the radio-frequency impedance of the load in the plate circuit, an important part of which may be the telephone receiver used. Measurements have therefore been made of the impedance of various commercial types of radio head sets using resonance methods. These measurements were made at frequencies of from 3,000 to 600,000 cycles, which, with the ordinary low-frequency bridge measurements, give the impedance over the entire range of frequencies at which receivers are used.—*Radio Laboratory, Bureau of Standards, Washington, D. C.*

WATT-HOUR METERS, EFFECT OF NON-SYMMETRICAL CURRENT WAVE UPON.

Studies are being made to determine the effect of non-symmetrical alternating current upon the accuracy of induction watt-hour meters. A meter is carefully adjusted and calibrated at unity power factor, and its behavior studied with a symmetrical emf. wave and non-symmetrical current wave obtained with a tungar tube.—*W. F. Davidson, University of Michigan, Ann Arbor.*

[There are some industrial loads in which the alternating current is partly rectified or made unsymmetrical; for example, all loads involving an electric arc. The question of the accuracy of induction-type meters on such loads has been asked more than once by operating companies.—EDITORS.]

Suggestions for Research

CHAINS, TRANSMISSION, STRESSES IN.

Silent chains, such as Morse, Reynolds, "Link-Belt," etc., are extensively used for high-speed electric drives. A theory is desired of the mechanical stresses in such chains, the curve form of the slack side, the pressures on the bearings, etc. The theory must particularly take into account the fact that the linear speed is high.—*Editorial Suggestion.*

FANS, ELECTRIC, RATING OF.

At the present time an electric fan is sold on the basis of the diameter of the blades, watts input into the motor, and, in the case of one or two makers, on the basis of the air delivery in cubic feet per minute. A universal standard is desired according to which fans of different makes and types could be directly compared with regard to their useful air supply. The latter must be defined not only in terms of cubic feet of air per minute in front of the fan, but also in terms of the average velocity and cross-section of the moving air at some agreed distance from the face of the fan. The latter data are desirable because a poor shape of the blades is conceivable with which large amounts of air might be "churned" in the vicinity of the fan, without throwing them forward. Air velocities may be measured (a) with a Pitot tube, (b) with a small disk held by a torsion spring at right angles to the blast, and (c) with an electric anemometer (see Research Section of April 19 and Dec. 20, 1919). A thorough investigation of the actual air currents will undoubtedly lead to further improvements in the shape of the blades and their best velocities. Fan designers might benefit from the recent vast experience of the builders of airplane propellers.—*Editorial Suggestion.*

WELDING, ELECTRIC, SPOT TYPE.

The present spot welders make one weld (or at most two) at a time. A natural development would be a multiple-spot welder which could make several welds simultaneously to save time. A still further, though more remote, improvement would be a continuous lap or seam welder which could make an uninterrupted weld between two plates. Such a weld would be of distinct advantage in shipbuilding and for high-pressure tanks. —*Editorial Suggestion.*

THERMOMETERS, RECORDING.

Temperature indicators of thermocouple and electric resistance type are usually dependable when well designed and carefully installed. Fairly inexpensive ones can be made, but they are not sufficiently dependable. There is a need for a reliable and inexpensive automatic temperature recorder for use in a great many industrial power plants and heat-treating processes. —*N. E. L. A. Prime Movers Committee.*

VENTILATION OF GENERATORS, CLOSED AIR CIRCUIT.

A system of generator ventilation by which the air is passed through cooling coils supplied with water and is used over and over again has been tried out in England. The advantages claimed are clean generators and less ability to sustain combustion on the occurrence of internal fires. Investigation is desired upon the effectiveness and economy of such a system and on the design of the cooling coils.

TELEPHONY, HIGH-FREQUENCY, ON POWER LINES.

Further investigation is desired on methods of "wired wireless" types of telephone communication over power lines. In a European installation with over 135 km. of power line an audion generator excites an aërial inductively coupled to the power line by suspension from the poles carrying it. Reception is effected either by an audion or by an ordinary crystal detector, the signals being of sufficient intensity to give a receiving intensity of 5 ohms (in parallel with a 4,000-ohm telephone), with 20 watts sending power. Both transmitting and receiving aërials are of the split-earth type, each branch differently tuned. This kind of communication is being considered by some of the power companies in this country.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Revised Revenue Bill Provides for Tax Reductions

AT A CAUCUS of Republican members of the House of Representatives Monday afternoon several vital changes in the revenue bill were ordered. These were embodied in a report submitted by the majority of the ways and means committee and call for a cut of almost half a billion dollars in federal taxes. The salient features of the bill of interest to the electrical industry follow: Repeal of excess profits tax, effective Jan. 1, 1922; repeal of surtax rates in excess of 32 per cent, effective Jan. 1, 1922; repeal of all taxes on freight, passengers, seats and berths; increase in income tax on corporations from 10 to 12½ per cent, effective Jan. 1, 1922; repeal of tax on electric fans; tax retained on telegraph, telephone and radio messages; permission to deduct reserve for bad debts, and a tax of 25 per cent in addition to other corporation taxes aimed at corporations, however created or organized, which are formed or availed of for the purpose of preventing the imposition of the surtax upon their stockholders or members through the medium of permitting their gains and profits to accumulate instead of being divided or distributed. Provision is made for a 5 per cent tax on portable light fixtures, including lamps of all kinds and lamp shades if sold for more than $10.

President McClellan Announces Committee Appointments

AT THE first meeting of the board of directors of the American Institute of Electrical Engineers for the administrative year beginning Aug. 1, 1921, held in New York on Tuesday of this week, President McClellan announced the committee appointments. The new chairmen will be:

Standing Committees.—Board of examiners, H. H. Norris, New York; code of principles of professional conduct, Comfort A. Adams, Cambridge, Mass.; co-ordination of Institute activities, W. I. Slichter, New York; executive, William McClellan, Philadelphia; finance, L. F. Morehouse, New York; headquarters, W. A. Del Mar, Yonkers, N. Y.; law, H. H. Barnes, Jr., New York; meetings and papers, E. E. F. Creighton, Schenectady, N. Y.; membership, E. H. Martindale, Cleveland; publication, A. S. McAllister, New York; public policy, H. W. Buck, New York; research, F. B. Jewett, New York; safety codes, H. B. Gear, Chicago; sections, John B. Fisken, Spokane; student branches, C. F. Harding, Lafayette, Ind.

Technical Committees.—Educational, C. E. Magnusson, Seattle; electrical machinery, B. A. Behrend, Boston; electrochemistry and electrometallurgy, Carl Hering, Philadelphia; electrophysics, F. W. Peek, Jr., Pittsfield, Mass.; industrial and domestic power, W. C. Yates, Schenectady, N. Y.; instruments and measurements, F. V. Magalhaes, New York; iron and steel industry, E. S. Jeffries, Hamilton, Ont.; lighting and illumination, C. E. Clewell, Philadelphia; marine, Arthur Parker, Camden, N. J.; mines, Graham Bright, Pittsburgh; power stations, H. P. Liversidge, Philadelphia; protective devices, H. R. Woodrow, New York; telegraphy and telephony, Donald McNicol, Roselle Park, N. J.; transmission and distribution, Edward B. Meyer, Newark, N. J.

In accordance with the by-laws of the Edison medal committee, the board of directors confirmed the appointment by President McClellan of new members of the Edison medal committee as follows: B. A. Behrend, Boston; John H. Finney, Washington, and C. S. Ruffner, Amsterdam, N. Y.—for terms of five years each. The board also elected three of its membership as members of the Edison medal committee for terms of two years each, namely, A. W. Berresford, Milwaukee; L. F. Morehouse, New York, and R. B. Williamson, Milwaukee.

Shutdown of Springfield (Ill.) Utility Service Averted

TOTAL shutdown of the light and power service at Springfield, Ill., was threatened this week at the expiration of the franchise of the Springfield Gas & Electric Company. The franchise expired on Aug. 15, and as the result of failure of the city to provide the necessary funds to carry out the arrangements made last spring for taking over the properties it seemed that the company would carry out its expressed intention of abandoning its light and power service. On Friday of last week, however, an ordinance extending the franchises of the company for twenty years was introduced and the City Council officially declared its intention of not interfering with the operations of the utility until final action on the franchise extension could be taken. The ordinance must lie over for a week before the Council can act on it and then cannot be submitted to the voters for twenty days. In the meantime the company is operating without franchise. Final action cannot be taken until some time in September, and then only if the Council acts promptly on the measure now before it.

Bonding of Electrical Contractors Is Required by Topeka Ordinance

AN ELECTRICAL ordinance passed by the city fathers of Topeka, Kan., on Aug. 9, requires a five-thousand-dollar bond for all electrical contractors and dealers in electrical supplies. It eliminates the license fee of $100 heretofore paid by such dealers and gives the city electrical inspector power to condemn electrical supplies and electric wiring that does not conform to the national electrical code. Mistakes and defects in wiring are penalized by shutting off the supply of electricity. A board of managers in electrical matters is provided in the ordinance, to include one journeyman electrician, one master electrician and the city electrical inspector. Violation of any provisions of the ordinance means a fine of from $5 to $50.

Hydro Radial Scheme Gets Severe Jolt

AN ADVERSE report on the project for constructing and operating a number of electric railways by the Hydro-Electric Power Commission of Ontario through an issue of bonds guaranteed by the provincial government has been made by the commission appointed by that government to investigate the matter—the commission condemning the scheme as "unwise and economically unsound." The estimates upon which the Beck project was based are found to have been prepared by inexperienced men, this applying both to construction costs and traffic expectations. The people of Ontario are reminded that their debt is mounting and are advised to wait for results from the elaborate system of highways before assuming further heavy obligations.

The reasons cited are as follows:

The financial condition of the electric railways in Ontario and in the United States has been precarious and unsatisfactory and the outlook discouraging. The evidence submitted indicates that the proposed electric railways would not be self-supporting. Their construction, paralleling and competing with the Canadian National Railways system, would be economically unsound and a serious blow to the success of government ownership. Until the Chippawa power scheme, estimated to cost $60,000,000 or upward, is completed and shown to be self-supporting, the government would not be justified in indorsing the construction of an electric railway system at an initial estimated cost of $45,000,000. The indorsement of bonds by the province for systems of electric railways at the instance of the municipalities concerned is held highly dangerous and likely to lead the province into great financial difficulties, as it would give rise to demands for like accommodation from other localities which it would be hard to refuse. The expenditure of $25,000,000 on public highways in the province having been begun, it would be unwise to commence the construction of electric railways until the effect of highway improvement has been ascertained and the use of them by motor cars and trucks made clearly apparent. The rapidly increasing debts and financial commitments of the Dominion, province and municipalities have aroused well-founded apprehension and are a cogent reason against the embarkation in the construction of the contemplated electric railways.

The report is signed by four of five members of the commission—Judge Sutherland, the chairman; General C. H. Mitchell, W. A. Amos and A. F. Macallum, C. E. The minority report, by Frederick Bancroft, labor representative, controverts most of the conclusions arrived at in the majority report, recommending that the government should adopt the principle of publicly owned and operated electric railways. He states that employment conditions should be taken seriously into account and that the hydro-radial development would bring considerable relief.

City of Boston Sues Edison Company on Account of Coal Clause

SUIT has been filed against the Edison Electric Illuminating Company of Boston by Corporation Counsel Hill of that city to recover $90,000 collected by the company in connection with the supply of energy to the municipality. The city contends that the coal clause and 10 per cent additional charge in effect at various times since September, 1917, are illegal. Corporation Counsel Hill asserts that the Massachusetts Department of Public Utilities, which is investigating the company's rates in a pending case brought by the city, can determine the future of the rates objected to, but that the courts must settle the disposition of moneys collected hitherto.

Preparations to Promote Electrical Export Trade

PLANS for the new commodity division of the Bureau of Foreign and Domestic Commerce dealing with export problems in electrical goods of all kinds are being worked out. The announcement of the appointment of R. A. Lundquist, an electrical engineer of Minneapolis, as chief of the division has been made. Mr. Lundquist has been investigating foreign markets for electrical goods for the bureau during the past five years.

The electrical division is one of the commodity divisions authorized recently by Congress at the personal request of Secretary of Commerce Hoover. Congress appropriated $250,000 for that purpose. It is expected that twelve or more divisions will be formed in an effort to assist the leading export industries to extend their foreign trade. The details of the organization of the individual divisions have not yet been worked out.

Important Merger of Utilities in Indiana

PROPOSED consolidation of seven Indiana electric light and power companies into the Indiana Electric Corporation, for which authority is asked in a petition filed with the Indiana Public Service Commission, will be thoroughly investigated by the commission at a public hearing, according to Chairman John W. McCardle. Articles of incorporation with a nominal capital of $10,000 have been filed in the office of the Secretary of State. It is understood that the corporation intends to conduct its affairs under this capitalization pending action of the Public Service Commission on its petition to complete the merger plan.

The companies concerned operate in a score of counties and have total property holdings valued at $18,250,000. They are the Merchants' Heat & Light Company of Indianapolis, the Indiana Railways & Light Company of Kokomo, the Elkhart Gas & Fuel Company, the Valparaiso Lighting Company, the Wabash Valley Electric Company of Clinton, the Putnam Electric Company of Greencastle and the Cayuga Electric Company.

It is the ultimate intention of the men backing the enterprise to build a great power house on the Wabash River in Vigo County, probably north of Terre Haute, at an expenditure of several millions of dollars, and to connect it with a system of transmission wires which will deliver electrical energy from the Indiana coal fields to many parts of the state. A triangular transmission line 300 miles long would distribute the energy, one line extending from the central plant to Kokomo, another to Indianapolis and the third from Kokomo to Indianapolis. The theory back of the plan is that of generating electricity in the heart of the coal fields and transmitting it by wire to remote sections of the state. Arguments in favor of such a system are that the small community would have the advantages of electric service from a superpower station manufacturing its energy with coal purchased without high freight rates. It is contended that the transmission of energy by wire is much cheaper than hauling coal across the state to rural communities.

The incorporators of the Indiana Electric Corporation are Joseph H. Brewer of Grand Rapids, Mich., president of the Merchants' Heat & Light Company; Charles O'Brien Murphy, vice-president and general

manager of the same company; Paul D. Birdsall, its secretary; Lex J. Kirkpatrick of Kokomo, vice-president of the Indiana Railways & Light Company, and Marshall V. Robb of Clinton, secretary of the Wabash Valley Electric Company. Mr. Brewer is president of the board of directors. Mr. Murphy is vice-president and treasurer, Mr. Kirkpatrick is a vice-president, and Mr. Birdsall is secretary. The plan of financing embraces the acquisition of the various properties by issuring $4,000,000 in common stock and $1,850,000 in 8 per cent preferred stock, $3,250,000 in 7.5 per cent fifteen-year first and refunding bonds, $2,250,000 in 7.5 per cent serial bonds maturing within fifteen years and $750,000 in one-year 8 per cent notes.

Analysis of Henry Ford's Muscle Shoals Offer

SINCE the publication of Henry Ford's offer for the government hydro-electric, steam and nitrate plants at Muscle Shoals, Ala., contained in his letter of July 8 to General Lansing H. Beach, chief of engineers, U. S. A., there has been a widespread and growing interest in the matter. Letters continue to pour into Washington to senators and representatives insisting that the government complete the project. Others are equally insistent that a policy of retrenchment and economy shall prevail. Senator Underwood, in whose state the projects are located, maintains that the operation of the Muscle Shoals plants by the government is the only way in which the public will receive the maximum benefit from this natural resource. Meanwhile, the War Department continues to ponder over Mr. Ford's offer and several others submitted to it in response to the request of the chief of engineers, with no indication of when a decision will be reached.

An engineer familiar with the power situation in the South and thoroughly conversant with all the government work at Muscle Shoals, Ala., when asked for an opinion of the Ford offer by the ELECTRICAL WORLD, said: "Mr. Ford proposes that Dam No. 2 (the Wilson Dam) shall be completed with an installation of 600,000 hp. at the expense of the government and turned over to him as soon as the initial 100,000 hp. is installed under a hundred-year lease agreement, renewable in perpetuity. The estimated cost to complete this work, as shown by official estimates, is $33,000,000, in addition to the $17,000,000 already spent, or a total of $50,000,000. For the use of this property Mr. Ford proposes to pay 6 per cent on $20,000,000 or $33 per horsepower installed—less than half the total cost—leaving the taxpayers to pay the interest on the remainder. Mr. Ford's proposed interest payment amounts to $2 per horsepower of installed capacity per year.

"Mr. Ford also proposes that the United States build Dam No. 3 with an installed capacity of 250,000 hp. and turn it over to him upon completion, under a hundred-year lease agreement renewable in perpetuity. This project is an entirely new one situated 17 miles above Dam No. 2, around which most of the discussion has centered. According to the government reports, this new dam would be about 6,300 ft. long (nearly one and a quarter miles long and 1,500 ft. longer than dam No. 2) and 50 ft. high, making available an effective head of 40 ft. on the turbines. No work has been done on the project and no property rights have been acquired by the government.

"The foundations of this dam have been questioned by expert geologists who passed favorably on the foundations of Dam No. 2. Approximately 30,000 acres of the finest bottom land in the Tennessee Valley in northern Alabama would be flooded out or damaged by this development. The cost of this dam and power plant, completed, as required by the Ford proposal, has been variously estimated under present-day costs at from $25,000,000 to $35,000,000, and for the use of this property Mr. Ford proposes to pay the government 6 per cent on $8,000,000—one-third to one-fourth of the total cost, and equivalent to $32 per horsepower of installed capacity and $1.92 per horsepower-year.

"Since both power plants will belong to the United States, Mr. Ford taking a lease on them, he would never have to pay any taxes or licenses of any character—a manifest injustice to and discrimination against other companies engaged in selling power to the public which have to pay state, county and city taxes and licenses.

"To those who must finance projects costing $200 and more per installed horsepower with existing interest rates averaging around 12 per cent or $24 per horsepower-year these figures will be amazing, and to the independent manufacturer who is endeavoring to meet competition without government assistance such figures are appalling. If the government enters into this arrangement, it will amount to a subsidy to Mr. Ford and his industries amounting to millions of dollars annually.

"Even the above interest charges do not apply during the early years of operation, for Mr. Ford will be virtually exempt from interest charges for the first five years of operation of Dam No. 2, paying only $200,000 per year and $160,000 per year for the first three years of operation of Dam No. 3, and in addition would pay absolutely no interest during the four-year construction period preceding the beginning of the lease. This exemption would be equivalent to another subsidy, as the rule of business is that interest on money shall begin with the day on which investment is made.

"Mr. Ford agrees to pay to the United States $55,000 annually for the repairs, maintenance and operation of the dams and the locks and gates of both dams. All repairs, maintenance and operation of same are left under the direction, care and responsibility of the United States. The amount allowed to the government for this purpose is grossly inadequate, and a large amount of government money will have to be provided annually for this purpose. The maintenance of about $3,000,000 worth of metal work in crest gates, lock gates, etc., would cost alone over $150,000 per year, or approximately three times as much as the entire allowance under this proposal for all repairs and maintenance.

"Mr. Ford's proposal is based upon two leases of 100 years duration, one for each of the two government dams. Each lease is to be automatically renewed at the end of its period. No provision is included for regulation of the selling price of products of the Ford company, and no license fees are to be paid. It in no sense conforms to the federal water-power act, which has many provisions to safeguard the public and requires all licenses on navigable streams to run for periods of not over fifty years."

OTHER PROPERTY ACQUIRED

In addition to the acquisition of the water-power plants on the terms given, Mr. Ford in his offer of July 8 proposes to acquire for the sum of $5,000,000 various nitrate plants, steam plants, transmission lines, sub-

stations, quarries and patents which have cost the government to date $87,346,897. On investigation the ELECTRICAL WORLD finds these to be as follows:

Nitrate Plants.—Nitrate Plant No. 1 embraces about seventy acres of land just outside the town of Sheffield and on the lines of both the Louisville & Nashville and the Southern Railroad as well as the local street railway. In addition to the power plant and process buildings, it comprises about twenty-five houses for general administrative purposes, employees' homes, etc., several miles of railroad siding and streets and recreation grounds. Its calculated capacity was 60,000 pounds of ammonia per day or 10,000 tons annually.

Nitrate Plant No. 2 is located on a bluff on the south bank of the Tennessee River and three miles east of Sheffield. The reservation is rectangular in shape with a river frontage of 10,900 ft. and a north and south depth of 9,200 ft., and it covers 2,200 acres. As at present completed, it constitutes the foundation of a splendid industrial plant capable with a few modifications of turning out other products and commodities than fertilizer.

The plant comprises more than seventy-five process buildings and a total of 2,400 structures including employees' quarters and houses. The reservation includes housing for a permanent town of 12,000 people with a filtration plant capable of serving 20,000 persons, a 65,000,000-gal. storage reservoir and settling tank, a sewage system, 19 miles of permanent roadway, 4 miles of trolley line and many miles of railroad siding.

The lime-burning plant includes several kilns, each capable of handling 200 tons of raw stone per day and producing 100 tons of burned lime. Used as a cement plant for which all necessary auxiliaries are available, the plant could produce 4,000 barrels of Portland cement per day, and, furthermore, with the raw materials and power at hand, this is an admirable location for such an industry.

The carbide department is complete in all details and can produce a daily output of 500 tons.

STEAM PLANTS, TRANSMISSION LINES, SUBSTATIONS, ETC.

Steam Plants.—(a) The steam plant at Nitrate Plant No. 1, which is up to date, has an installed generating capacity of 5,000 kw. and is equipped with all modern equipment such as underfeed mechanical stokers, condensers, cooling ponds, etc.

(b) The steam plant at Nitrate Plant No. 2, with a capacity of 60,000 kw. in one high-efficiency unit, is, on account of its size, even more completely equipped than the No. 1 plant. The manufacturers have estimated that this plant may be operated with a lower coal consumption than any other plant in the world.

(c) The extension of the Warrior Reserve steam plant at Gorgas, with an installed capacity of one 30,000-kw. steam-turbine generating unit and twelve 1,200-hp. boilers, with all auxiliaries, is located in the heart of the Black Warrior coal fields, on the banks of the Warrior River, with ample condensing water and coal-handling facilities.

This last-named plant and that at Nitrate Plant No. 2 are the largest and most complete steam plants in the South, and all three plants are of permanent character, designed and built for many years' service, and are in distinct contrast with the temporary types of construction as employed in cantonments and other war buildings.

Transmission Lines.—The 110,000-volt, 30,000-kw. transmission line, 90 miles in length, connects the steam plant at Gorgas with Nitrate Plant No. 2. This line is fitted with the latest type of insulation and is paralleled by a private telephone line. Patrolmen's houses are located at several points along the line.

Substations.—The substations are at each end of the Gorgas-Nitrate Plant No. 2 transmission line. In them are installed two banks of three 6,666-kva., 110,000-volt to 13,200-volt water-cooled transformers together with high-tension oil switches, lightning arresters and control apparatus. Each substation has a rated capacity of 40,000 kva.

Waco Quarry.—This quarry is near Russellville on a branch of the Southern Railway and is served by the Gorgas-Nitrate Plant No. 2 transmission line. An ample supply of limestone may be secured from this quarry, and the government has already expended several hundred thousand dollars in the development to provide sidings, quarry tracks, quarrying and pumping machinery, etc.

Patents, Processes, Methods and Designs.—In connection with the two nitrate plants the government acquired as licensee the right to use various patents, rights and privileges in manufacturing nitrates for war purposes. An exact tabulation of these rights and their value is from their very nature difficult, but their value is estimated in millions.

RESULT TO TAXPAYERS

Thus it would appear that Mr. Ford, by paying to the government $5,000,000 for property which cost the government more than $87,000,000 and annual interest and sinking fund payments eventually equivalent to $2 per horsepower of installed capacity, proposes to acquire perpetual control of all the natural resources at Muscle Shoals, plus the property placed there by the government, at a total cost to the government, with the new money the offer calls for, of $162,346,897. In addition, Mr. Ford would receive perpetual exemption from state and federal taxes and license fees on the water-power properties which all other developers of hydro-electric power must pay. Far from relieving the government of financial burdens, it is claimed, the plan would plunge it into new expenditures of many millions of dollars. It holds out a specious promise of cheap fertilizer which on examination proves to be no promise at all, and it offers the government little or nothing though exacting much.

Formally presented at the outset by skillfully worded statements and headlines in the newspapers, and supported by a campaign of propaganda for which, it is claimed, funds have been openly solicited and collected in the South, Mr. Ford's offer has undoubtedly received favorable public attention, unjustified by the facts. Fortunately the War Department officials charged with responsibility in the matter are not affected by such propaganda and are analyzing the proposal in detail. They will no doubt not enter on any program until the final cost can be reasonably ascertained.

Executive Committee of Southwestern N. E. L. A. Holds Meeting

A MEETING of the executive committee of the Southwestern Geographic Division, N. E. L. A., was called at New Orleans for Aug. 19 and 20 to outline the work of the division for the coming year. The division embraces the states of Arkansas, Louisiana, Mississippi

Oklahoma and Texas. The movement to hold sectional gatherings of the division periodically, where subjects of special interest to those engaged in the industry can be discussed and an interchange of views on financial, advertising and other matters may take place, is said to be gaining support in this territory. W. E. Clements of the New Orleans Railway & Light Company had charge of the arrangements for the executive committee meeting this week.

Great Lakes Division, N. E. L. A., Changes Date of Convention

THE date for the annual convention of the Great Lakes Division of the National Electric Light Association at French Lick Springs, Ind., has been changed from Sept. 14, 15 and 16 to Sept. 21, 22 and 23. The meeting will be held in conjunction with that of the Indiana Electric Light Association. The program has been only partly arranged and tentatively includes an address by Milan R. Bump, president National Electric Light Association; a paper on "Contract Routine" by R. T. Duncan, Detroit Edison Company; an address on "The Analysis of Kilowatts Sold for Residence Use" by George Neal, a report on "Electric Vehicle Progress" by L. T. Carpenter, Commonwealth Edison Company, and a talk on "The Illinois Committee on Public Utility Information and Its Future Plans" by B. J. Mullaney. It is probable also that Martin J. Insull, past-president of the National Electric Light Association, and John F. Gilchrist, vice-president Commonwealth Edison Company, will address the meeting on subjects not yet announced.

President Bump Completes N. E. L. A. Committee Appointments

IN ADDITION to appointments of committee chairmen already announced, President Milan R. Bump of the National Electric Light Association has made the following appointments of chairmen of special national committees: National counselor to the United States Chamber of Commerce and national representative upon the National Industrial Conference Board, John W. Lieb, New York Edison Company; finance committee, Joseph B. McCall, Philadelphia Electric Company; water-power development, Franklin T. Griffith, Portland (Ore.) Railway, Light & Power Company, electrical resources of the nation, M. S. Sloan, Brooklyn (N. Y.) Edison Company; lamps, Frank W. Smith, United Electric Light & Power Company, New York; wiring, R. S. Hale, Edison Electric Illuminating Company of Boston; insurance, S. E. Wolff, Hodenpyl, Hardy & Company, New York; constitution and bylaws, W. C. L. Eglin, Philadelphia Electric Company; Doherty and Billings prizes, A. S. Loizeaux, Consolidated Gas, Electric Light & Power Company, Baltimore.

The following have been appointed by President Bump as chairmen of general national committees: Accident prevention, Charles B. Scott, Bureau of Safety, Chicago; company employees' organizations, R. B. Grove, United Electric Light & Power Company, New York; membership, Walter Neumuller, New York Edison Company.

The second meeting of the national executive committee, including the chairmen of committees named above, will be held at national headquarters Thursday, Sept. 1, to consider the N. E. L. A. program for the year and to take up important matters including the approval of budgets for divisional, sectional, committee and headquarters' activities.

Women to Participate in Public Relations Section Work

A FEATURE of the work of the Public Relations Section of the N. E. L. A. during the coming year will be the educational work to be carried on with the assistance of the women of the industry and other women, as shown by the appointment of a woman's committee on public information, which has just been announced by Chairman Martin J. Insull of that section. This committee will be headed by Miss S. M. Sheridan, Detroit Edison Company, the other members being Miss B. H. Lowerie, H. L. Doherty & Company, New York City; Miss O. A. Bursiel, Boston; Miss C. H. Zillerson, Philadelphia Electric Company, and Miss R. E. McKee, Middle West Utilities Company, Chicago.

Two other new committees are included in the organization of the Public Relations National Section. These are a committee on employee relations with the public and a committee on public speaking. Their chairmen will be H. C. Blackwell, Kansas City (Mo.) Power & Light Company, and H. C. Couch, Pine Bluff (Ark.) Company.

Howard T. Sands of Charles H. Tenney & Company, Boston, has been appointed chairman of the committee on state organization of public utility information; W. W. Freeman, Union Gas & Electric Company, Cincinnati, of the committee on uniformity of state regulatory laws; M. S. Sloan, Brooklyn (N. Y.) Edison Company, of the committee on relations with bankers; F. R. Coates, Toledo Railways & Light Company, of the committee on upholding the industry, and P. L. Thomson, Western Electric Company, of the manufacturers' advertising committee.

Michigan Electric Light Association Arranges Program

THE tentative program arranged for the annual convention of the Michigan Electric Light Association, to be held at the Hotel Ottawa, Ottawa Beach, Mich., on Tuesday, Wednesday and Thursday of next week, Aug. 23 to Aug. 25, includes an exhibition on the opening day of a publicity motion picture prepared by the National Electric Light Association. On Wednesday there will be addresses by George E. Lewis, president of the association; Milan R. Bump, president of the N. E. L. A.; M. H. Aylesworth, executive manager of the N. E. L. A., and W. L. Goodwin, representing the Society for Electrical Development. At the banquet in the evening Alex Dow, president Detroit Edison Company, will speak.

On Thursday there will be reports from the committee on public information, of which H. H. Tinkham is director; the committee on overhead lines, E. Holcomb chairman, and the committee on safe wiring, J. C. Langdell chairman. James V. Oxtoby of the Detroit bar and W. W. Potter, chairman of the Michigan Public Utilities Commission, will speak. Entertainment features of the convention include dancing and tournaments at golf and cards.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Municipal Light Plant Makes Good Showing.—The city of Tacoma's municipal lighting plant made a net profit of $342,979 for the first half of 1921, according to an official report published recently. For the three years 1918 to 1921 inclusive the annual net profits have averaged over $450,000.

Spectacular Lighting Effects for Electrical Show.—New York City, according to the *Edison Monthly*, will be treated to something new in spectacular lighting effects when its electrical show opens in the Seventy-first Regiment Armory on Sept. 28. Illuminating engineers are working on plans to flood the tall tower of the armory with light. The scheme will, it is said, probably combine features of outline illumination and floodlighting with the jewel effects which were developed for the Panama-Pacific Exposition. A battery of searchlamps which will send rays to all parts of the city will top the display.

The Cobbler's Child at Last Gets Shod.—Although only a few miles from Niagara Falls, the village of Queenston, Ontario, was not served with electric power until this summer, when a new "Hydro" distributing line was placed in operation. Sixty villagers, says the *Canadian Engineer*, have now at last put away their oil lamps and purchased tungsten bulbs. Power lines have radiated in many directions from the Falls for many years, carrying power to communities hundreds of miles away, but it happens that Queenston is not in the direct path of any of these lines, and it was not until last winter that the village authorities issued debentures to pay the cost of building a transmission line from Niagara.

Chicago Utility Development Portrayed in Booklet.—A graphic portrayal of the development of public utilities in Chicago since 1849 is given in a booklet just published for the Chicago Publicity Club by the Illinois Committee on Public Utility Information. The publication is designed for distribution to all Chicago users of public utilities, which includes virtually the entire population of the city, and plans are under way to make the distribution even wider. The pamphlet gives historical and other data on the electric light and power companies of Chicago, the elevated railroads, the surface lines, the telephone and the gas industry. It draws a sharp contrast between present conditions and those when local utilities were small or did not exist at all. The publication is in line with other activities of the committee.

Byllesby Sales of Stock to Customers Increase.—Despite prevailing financial and industrial conditions, says the *Byllesby Monthly News*, the Byllesby utility companies, pioneers in the customer-ownership movement, have had no difficulty beating the preferred-stock sales record of the first half of last year. Gross sales reported for the first six months of 1921 aggregated $3,877,000 par value, distributed in 7,220 separate transactions. This is an increase of 20 per cent in the volume of securities sold. In June there was the usual seasonal decline in sales, but at the same time upward of $500,000 of preferred stock was placed with the customers of the companies.

Driverless Automobile Controlled by Radio.—Hundreds of people hurrying to work in Dayton, Ohio, one morning recently stopped in amazement as they saw an oddly shaped driverless car about 8 ft. long wend its way through the business section. What they saw, reports a New York *Times* correspondent, was the first radio-controlled car. In the experiment, conducted by Captain R. E. Vaughn of McCook Field, the car was guided through the traffic by a radio apparatus, attached to an automobile, following 50 ft. behind it and operated by Vaughn. As the car approached street intersections traffic signals were observed, and the horn was blown if some pedestrian or other obstacle got in the way.

Detroit May Procure Power from Ontario Hydro System.—Mayor Cousins of Detroit is quoted in the daily press as asserting that, following a conference with Sir Adam Beck, chairman of the Ontario Hydro-Electric Power Commission, a draft contract between the city of Detroit and the commission for the supply of hydro-electric power from Niagara would be drawn up for submission to the Detroit City Council. The initial supply, the report says, will be about 60,000 hp. Eventually a new transmission line will have to be constructed. Mayor Cousins is said to expect that the city will not only be able to operate new municipally owned street railway lines with this power but to light its streets as well.

Utah Case to Go to Supreme Court.—An appeal to the United States Supreme Court has been taken by some of the customers involved in the "special contract" case, wherein the Public Utilities Commission of Utah decided some time ago that a number of the special contracts of large power customers of the Utah Power & Light Company were discriminatory and ordered them placed on standard schedules. The appeal is taken to obtain final decision as to the right of the Public Utilities Commission of Utah, under the law of Utah and the federal constitution, to change the rates fixed in the contracts, the contention of the appellants being that the contracts were signed before the utilities act of the state went into effect and that the commission had no power to alter them. The commission assumed the power to change the rates as the result of a long hearing, and its decision was sustained by the Supreme Court of Utah.

Power Surcharge Rate Investigation.—The Board of Public Utility Commissioners of New Jersey has inaugurated a series of hearings to investigate the 25 per cent power surcharge of the Public Service Electric Company. The inquiry has a unique feature in that it will include only 240 customers of the company, or the wholesale power users on the system. In 1919 about 80 per cent of these users urged the commission to continue the surcharge.

Associations and Societies

Northwest Association Chairmen.—At a meeting of the executive committee of the Northwest Electric Light & Power Association held in Portland, Ore., chairmen of the four association sections were chosen as follows: Accounting Section, J. S. Simpson, Spokane; Commercial Section, A. C. McMicken, Portland; Public Relations Section, W. H. McGrath, Seattle; Technical Section, Markham Cheever, Salt Lake City. Boise, Idaho, was selected for the convention of June, 1922.

N. E. L. A., Iowa Section.—This section has elected the following officers for 1921-22: President, S. C. Dows, Iowa Railway & Light Company, Cedar Rapids; vice-presidents, C. N. Chubb, People's Light Company, Davenport, and C. A. Sears, Mississippi River Power Company, Keokuk; secretary-treasurer, M. G. Linn, Des Moines Electric Company. F. J. Hanlon, O. H. Simonds, F. H. Brooks, C. S. Macy, A. W. Jones, H. Bellamy, E. F. Bulmahn, W. J. Bertke, Don Sterns, Chris Miller and John A. Reed from the executive committee.

Coming Meetings of Electrical and Other Technical Societies

Michigan Electric Light Association — Ottawa Beach, Mich., Aug. 24-25. (For program see "News of the Industry.")

N. E. L. A., New England Division—New London, Conn., Sept. 6-9.

International Association of Municipal Electricians — Colorado Springs, Col., Sept. 6-10.

Pennsylvania Electric Association—Bedford Springs, Pa., Sept. 7-10.

N. E. L. A., Nebraska Section — Omaha, Sept. 14 and 15.

N. E. L. A., Great Lakes Division, and Indiana Electric Light Association—French Lick Springs, Sept. 21-23. (For program see "News of the Industry.")

Association of Iron and Steel Electrical Engineers—Chicago, Sept. 19-24.

N. E. L. A. Rocky Mountain Division, and Colorado Electric Light, Power and Railway Association — Glenwood Springs, Sept. 19-21.

West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers—Huntington, W. Va., Sept. 20-23.

Illuminating Engineering Society—Rochester, N. Y., Sept. 26-29. (For program see issue of Aug. 13, page 336.)

American Electrochemical Society — Lake Placid Club, N. Y., Sept. 29-Oct. 1.

American Electric Railway Association — Atlantic City, N. J., Oct. 3-7.

Empire State Gas and Electric Association —Lake Placid, N. Y., Oct. 6 and 7.

N. E. L. A., Southeastern Section—Chattanooga, Tenn., Oct. 18-20.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Examination of Utility's Books.—The cities of Elkhart, Ligonier, Mishawaka and South Bend and large power users established therein having applied to the Indiana Public Service Commission for an order granting authority to examine the books and property of the Indiana & Michigan Electric Company, the commission denied the application, asserting that it had no jurisdiction to make such an order, except in the case of an agent on its own staff.

Reproduction Cost During 1919-1921 Not Reasonable Rate Base.—"The commission does not hesitate to state," declared the California Railroad Commission recently in its Southern California Edison rate hearings, "that reproduction cost new, or reproduction cost depreciated, based upon price conditions existing during 1919, 1920 and 1921 is not a reasonable basis for rate-fixing purposes, except in so far as it applies to those portions of the properties that were of necessity constructed during the period of high prices."

Inductive Interference.—In handing down its decision in what is known as the Homer inductive interference case (see ELECTRICAL WORLD, July 9, page 84), the Illinois Public Utilities Commission made this succinct statement of the legal issue involved: "The law is clear that public utility companies exercising similar franchises, such as companies operating transmission, telephone and telegraph lines, have equal rights in the highways, and that priority of occupancy by one company does not give to that company the right to exclude other such companies from occupying the highway. Prior occupancy may perhaps give the prior occupant a right superior in some respects to that of a later comer. This superior right, however, is limited to protection from interference substantial in character."

What Is a Just Mean Between Two-Year and Ten-Year Averages in Fixing Value? — In placing a valuation of $585,835 on the electric property and $469,252 on the gas property of the Superior Water, Light & Power Company, which the city of Superior is acquiring in condemnation proceedings, the Wisconsin Railroad Commission thus explained how it arrived at these figures, which are nearly 40 per cent under those of the company's engineers: "The company relies upon the two-year average figures and upon the unit costs of 1920. These are so far out of line with unit prices which formerly prevailed and so far removed from actual investment costs that, in our opinion, they should not be given the controlling influence which the company seeks for them. They may, perhaps, be wholly out of line with prevailing prices in the not far distant future. They represent a temporary and sporadic condition. They would place the purchasers of this property under such heavy burden of investment as to be wholly unreasonable. They represent a figure which, in our opinion, could not be secured from a willing purchaser capable of negotiating with the company were the company seeking a fair purchase price for its property. The reproduction cost estimate on the ten-year average basis ended April 1, 1919, of the commission engineers represents, on the whole, some inclination to the pre-war level and includes some low-level years. We believe, therefore, that a level of unit prices somewhat higher than shown by this ten-year average is justified. The city has furnished us no estimates of reproduction cost, the company only with the reproduction estimates already referred to. There is no five-year average in evidence. A five-year average ending with the year 1919 would contain four years which clearly represented the war-inflated values and only one year, namely, 1915, approaching a pre-war level. We think this would represent a somewhat higher level than should be accepted. We have made sufficient investigation of the unit costs through our staff to arrive at the conclusion that such five-year average would not be far from a reproduction cost new of $1,398,000 and a reproduction cost, less depreciation, of about $1,060,000, omitting materials and supplies. But for the reasons already expressed, and taking all things into consideration, we are inclined to consider these figures as somewhat high as final basis for fixing the valuation when the investment and other elements are also taken into account."

Legality of "Period of Repose."—An important decision made by the New York Public Service Commission, Second District, before its supersession this year, hinged on the power of the commission to change the rates of a petitioning company for a second time within the period—in the case at issue twelve months—set in the order last issued. By a vote of three to two, the commission held that the statutes in fixing a "period of repose" had made a new revision within that period impossible, and one was therefore denied to the Lockwood Light, Heat & Power Company, even though the chairman of the commission expressed the opinion that evidence presented showed the company to deserve higher rates. The dissenting members held that the law should not be construed to prohibit a rate change when unexpected conditions had made the rate either unreasonable and extortionate to customers, or so low as to threaten the ability of the corporation to continue its service. The petition, these commissioners held, should be treated as an application for a rehearing.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Power of Reviewing Commission Decisions in Illinois.—The Public Utilities Commission of Illinois is given no arbitrary powers by the statute creating it, the Supreme Court of that state has declared (ex rel. Illinois Central Railroad Company vs. Smith), and its orders and decisions must be reasonable and lawful. Reviewing courts will examine the facts on which the commission's order is based, and if there is substantial evidence to sustain it, the order will be sustained. (131 N. E. 371.)*

Municipally Owned Public Utilities Do Not Need Certificate of Convenience and Necessity.—The Los Angeles Gas & Electric Corporation brought an action to enjoin the Department of Public Service of the city of Los Angeles and the Board of Public Service Commissioners of that city from erecting and operating an electrical plant until the California Railroad Commission should issue a certificate of public convenience and necessity therefor. The District Court of Appeal affirmed the judgment of the court of first instance for the defendant on the ground that, the Railroad Commission having no authority to regulate municipally owned utilities, no such certificate was necessary, and the Supreme Court denied a further hearing. (197 Pac. 962.)

What Are "Just and Reasonable" Rates?—"To make an order requiring a public utility to set apart yearly a depreciation fund of a fixed amount and to prevent a compliance by refusing the income necessary for that purpose is not the fixing of a just and reasonable rate," the New Jersey Supreme Court asserted, in Public Service Railway Company vs. Board of Public Utility Commissioners, in the course of a decision upsetting the commission's findings upon the company's application for a 10-cent fare and remanding the case to the commission with instructions to fix a rate which would be just and reasonable. "The question is not a novel one, for in many municipalities in other states the rate has been fixed at 10 cents, sometimes with a qualification that tickets of a given quantity shall be sold at a less rate, but all having a tendency to approximate that rate, but in this proceeding the board did nothing along that line; it merely refused to do anything to advance the present rate, which the evidence shows is not just and reasonable in view of existing conditions."

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

Edwin Gruhl, who was elected a vice-president of the North American Company about a year ago, has recently been appointed general manager work-

EDWIN GRUHL

ing with the new president, Frank L. Dame. Mr. Gruhl has been closely associated with the executive matters of the company since November, 1912, when he was made assistant to the president. He was graduated from the University of Wisconsin in 1908 but delayed his course one year to engage in valuation work with the engineering staff of the Wisconsin Railroad Commission. Later he served as the statistician of that commission until his connection with the North American Company. Mr. Gruhl is also vice-president of the Wisconsin Edison Company, Inc., and president of the Wells Power Company, a subsidiary of the former.

B. M. Larsen has been elected a fellow in the University of Washington for electrometallurgical work in the Bureau of Mines station at Seattle.

Roy E. Chatfield has left educational pursuits in California to accept the post of executive secretary for the British Columbia Electrical Development Association, with headquarters at Vancouver.

L. G. Van Ness, formerly vice-president of the Memphis (Tenn.) Gas & Electric Company, and well known in the Middle West as an electrical engineer, has been appointed general manager for the receivers of the Cincinnati, Lawrenceburg & Aurora Electric Street Railroad. For the last three years Mr. Van Ness has had an office in Cincinnati as a consulting engineer.

G. F. Klein has been appointed assistant chief engineer of the Union Electric Light & Power Company, St. Louis.

William M. Eader, Frederick, Md., has been appointed engineer in charge of the municipal electric light plant and system.

B. T. Ergenbright, who has been manager for the Southern Sierras Power Company at Victorville, Cal., has resigned to become manager of the Bear Valley Utilities Company.

Peter Cooper Hewitt underwent an operation in Paris on Tuesday, Aug. 16, for abdominal trouble. A dispatch to the daily press says that the surgeons expressed entire confidence in his rapid recovery.

Dr. Irving Langmuir, assistant director of the research laboratory of the General Electric Company, sailed for Europe Aug. 13 to attend the annual meeting of the British Association for the Advancement of Science, to be held in Edinburgh, Scotland, Sept. 7 to 14. He will also attend a meeting of the Faraday Society in London on Sept. 28, and will be awarded the honorary degree of doctor of laws by the University of Edinburgh on Sept. 13. Dr. Langmuir will open the discussion on molecular structure at the British Association meeting. He will also read a paper before the Faraday Society on chemical reactions on surfaces and open

IRVING LANGMUIR

discussion on that subject. During his stay abroad he will make a business trip to a number of European countries. He is expected to be absent from the United States between two and three months.

Emmet N. Britton, formerly managing editor of the *Journal of Electricity and Western Industry*, has resigned to become assistant to the general manager of the San Joaquin Light & Power Corporation, with headquarters in Fresno, Cal. Mr. Britton will devote his attention particularly to public relations and the extension of the public policy of the San Joaquin Light & Power Corporation, which has been found of such great value in the recent rapid expansion of the company. Mr. Britton is a native Californian. He was born in 1892, was graduated from the University of California in electri-

E. N. BRITTON

cal engineering in 1914, and subsequently was in the employ of the Pacific Gas & Electric Company as superintendent of the Drum district and of the gas works in Sacramento. He served in the war as first lieutenant in charge of communication for the 363d infantry. Mr. Britton was first connected with the San Francisco office of the McGraw-Hill Company in the spring of 1920. He is a son of John A. Britton, vice-president and general manager of the Pacific Gas & Electric Company, who is widely recognized as the dean of the electrical industry on the Pacific Coast because of his broad vision and the influence he has wielded in electrical development in that section during the past forty-seven years. The younger Britton possesses many of the characteristics of his father, and has already won distinction from his studies and interpretations of the influence of electric service in the development of Western industries.

J. B. Wheeler has been appointed assistant chief engineer of power plants in charge of the Ashley Street station of the Union Electric Light & Power Company, St. Louis.

Dr. Albert A. Michelson of Chicago, winner of the Nobel prize for physics in 1907, has gone to Pasadena, Cal., to resume the experiments in measurement of light that he carries on annually in association with the Mount Wilson Solar Observatory and the California Institute of Technology.

R. A. Lundquist, electrical engineer, Minneapolis, has been appointed by Secretary of Commerce Hoover to take immediate charge of the new commodity division which will deal with export problems in electrical goods of all kinds. Mr. Lundquist was born in Red Wing, Minn., and received his primary education there. His higher education was obtained at the University of Minnesota, from which he was graduated with the degree of electrical engineer in 1905. His first engineering position was with the Missouri River Car Company. He was stationed at Helena, Mont., as assistant to the company's electrical engineer there. He spent the summer of 1907 at the Westinghouse plant in order to acquire manufacturing experience. Later in that year he became connected with the La Crosse (Wis.) Water Power Company as an electrical

R. A. LUNDQUIST

engineer. He retained that position until 1911, when he opened an office in Minneapolis to do general consulting work. He continued in that field of activity until 1916, when he undertook an investigation of the foreign electrical field for the Bureau of Foreign and Domestic Commerce. On his first trip abroad he investigated the markets for electrical goods in Australia, New Zealand, China, Japan, Korea and eastern Siberia. On a second trip for the Department of Commerce Mr. Lundquist visited British South Africa, Portuguese East Africa, British East Africa and India.

Commander C. S. McDowell, U. S. N., former vice-president of the A. I. E. E. received the honorary degree of doctor of science from the University of Wisconsin.

Brig.-Gen. George H. Harries, vice-president of H. M. Byllesby & Company, who acted as chief of the allied commission in charge of prisoners of war in Germany after the armistice, has been decorated with the Order of Leopold by the Belgian Ambassador, in recognition of his services in behalf of the Belgian prisoners. The ceremony took place recently at the Belgian Embassy in Washington in the presence of officers of the Belgian and American armies.

M. P. H. Smith has been appointed manager of the power division of the Atlanta office of the Westinghouse Electric & Manufacturing Company.

H. H. Bradley of the International General Electric Company has left the Schenectady office of the company to become its special representative in San Juan, Porto Rico.

John J. Swan has become associated with the Engineering Business Exchange, New York. Mr. Swan was formerly connected with the Prest-o-Lite Company, Indianapolis.

John D. Nicklis has been appointed manager of supplies and purchases of Manning, Maxwell & Moore, Inc., and affiliated companies, with headquarters at 119 West Fortieth Street, New York.

J. D. Sparks has been appointed representative in Utah, Idaho and Montana of Landers, Frary & Clark, New Britain, Conn. Mr. Sparks was formerly employed in the sales department of the Western Electric Company, Salt Lake City.

Everett Morss, president, Simplex Wire & Cable Company, Boston, has been elected president of the Boston Chamber of Commerce. Mr. Morss is chairman of the executive committee and a member of the corporation of the Massachusetts Institute of Technology.

D. W. Niven, for twenty-one years connected with the General Electric Company and since 1910 with its marine department, has been appointed manager of that department. He entered the employ of the company as a test man in the switchboard drafting department, later becoming connected with the power and mining engineering department.

Joseph D. R. Freed, who during the war was radio engineer at the radio test shop in the Washington (D. C.) Navy Yard and subsequently for over two years designing engineer and then assistant chief engineer of the Wireless Improvement Company, has organized the Radio Manufacturing Company, 156 Fifth Avenue, New York, to manufacture radio apparatus of all kinds. Mr. Freed will also act in the capacity of consulting radio engineer and is prepared to undertake radio engineering commissions.

D. E. Hayner, formerly with the Harry M. Hope Engineering Company, Boston, is now connected with the Interborough Rapid Transit Company, New York City, in the capacity of assistant engineer in the economic division. Mr. Hayner's experience has been largely in the electrical design of stations and industrial plants. He was engaged in this line while with the Harry M. Hope company. Previously he had been with the General Electric Company as designer, including some time spent on the design of the control boards of the Panama Canal locks. Among other connections he has held positions with the Electric Bond & Share Company, New York City; Stone & Webster, Boston; Monks & Johnson, Boston, and the New York Municipal Railway Corporation.

Hoyt Catlin has been made advertising manager of the Bryant Electric Company, Bridgeport, Conn. He was formerly with Landers, Frary & Clark, New Britain, Conn., and has been identified with the electrical industry for many years.

Obituary

George W. Thomas, president R. Thomas & Sons Company, manufacturer of electrical porcelain, East Liverpool, Ohio, died at his home in that city on Aug. 7, following a long illness. Mr. Thomas was born in East Liverpool in 1852, and in 1869 became associated with his father in the manufacture of doorknobs first at Beaver Falls, Pa.,

G. W. THOMAS

and afterward at East Liverpool and Lisbon, Ohio. In 1896 the Lisbon plant was devoted exclusively to the manufacture of electrical porcelain, a line of business in which the firm was a pioneer. It is said to have been the first to make porcelain for use on high-voltage transmission lines. Mr. Thomas was also identified with silica-producing firms in East Liverpool and in Oregon, Ill.

George D. Munsing, for several years manager of the Consumers' Electric & Street Railway Company of Tampa, Fla. (now the Tampa Electric Company), died recently at Red Bank, N. J.

Charles O. Bond, manager of the physical laboratory of the United Gas Improvement Company of Philadelphia, died on Aug. 2. He was the first past-president of the Illuminating Engineering Society to die since the society was founded in 1906. Mr. Bond was elected president of the society in 1913 and had previously been a vice-president. Throughout the life of the society he had been prominent in committee work, and he had served for a number of years on the committees on lighting legislation, nomenclature and standards, and reciprocal relations. He was also a member of the society's war service committee.

Trade and Market Conditions

Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies

Some Further Price Reductions on Power Apparatus

SINCE the announcement of price reductions of 10 per cent on integral motors, control and starting equipment, effective about July 9 to July 12, some further reductions have been announced at various dates since then and on several kinds of electrical equipment. Oxide-film lightning arresters show an average lower list price of about 8 per cent, effective Aug. 8. Certain makes of distribution transformers in sizes up to 500 kva. were lowered about 10 per cent around July 21 and 22. At least one make of station relay on Aug. 12 was reduced 10 per cent. Some fractional-horsepower motors were marked off 10 per cent the last week in July, while others in the single-phase type only did not come down till Aug. 3.

Inquiries are apparently increasing in number for motors, and here and there the orders are coming in in slightly greater volume, but still each order is rather small in value. Figuring of inquiries and proposition work are keeping motor salesmen busy.

Seven Millions to Be Spent for Telephones

THE National Administration of Posts and Telegraphs of Uruguay, according to reports from Montevideo, has signed provisionally a contract with an American banking syndicate headed by the Equitable Trust Company of New York for a loan of $9,000,000. The money is to be used for the construction of an underground telephone system. It will be issued, it is said, at 91 and bear interest at 8 per cent. The understanding is that the money will remain in the United States for the purchase of material. Conditional on the successful negotiation of the loan, the contract has been placed with the Western Electric Company for the entire telephone plant, both inside and outside, to the extent of about $7,000,000

Cases of Motor-Driven Devices to Be More Fully Marked

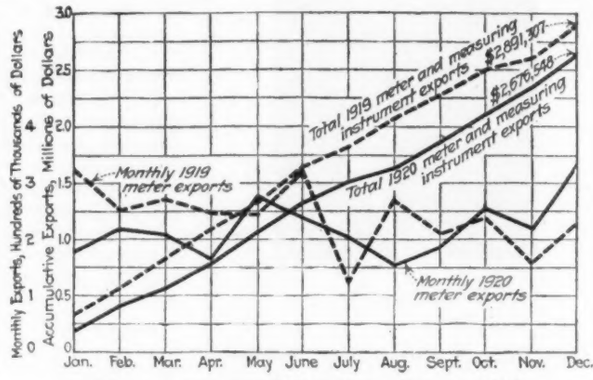
ONE of the recommendations which were unanimously adopted by the members of the Electrical Supply Jobbers' Association at their last general meeting, held in May, was "that manufacturers of motor-driven devices be requested and urged to mark plainly cases in such a way that information concerning voltage, frequency and the serial number of the motor can be readily ascertained, as well as other important details with reference to the appliance, without in any case making it necessary to open the box or crate to learn the details concerning the appliance packed therein."

The recommendation was drawn up by the committee on motor-driven devices after a careful study of the situation, as a means of overcoming some of the difficulties encountered by jobbers, distributers and dealers in warehousing and selling these devices. On July 15 the national representative of the association sent copies of this recommendation to all manufacturers of motor-driven devices asking their co-operation, and to date he has received sufficient answers to satisfy himself that the jobbers are being supported in their request. Many answers state that the marking is now being placed on the cases and others that it will be done. The secretary of the American Washing Machine Manufacturers' Association, for instance, has taken the matter up with all members of that association and is waiting for the replies.

British Possessions Import Meters Heavily in 1920

FOR the year 1920 exports of meters and measuring instruments from the United States amounted to a value of $2,676,548. This figure is 8 per cent less than the exports for the previous year, which amounted to $2,891,307. Canada took the greatest amount, with $488,568, while Japan was a close second and England a poor third. Cuba, fourth, took a large amount for that island, but it was only one-third that of Canada.

In considering these exports from a national standpoint, England and her possessions—Canada, Australia, New Zealand and British South Africa—took meters and measuring


Monthly Exports, Hundreds of Thousands of Dollars
Accumulative Exports, Millions of Dollars
Total 1919 meter and measuring instrument exports $2,891,307
$2,676,548
Total 1920 meter and measuring instrument exports
Monthly 1919 meter exports
Monthly 1920 meter exports
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.

METER EXPORTS IN 1920 BELOW THOSE OF 1919

instruments in value of $922,177, 34 per cent of the total exports.

From a geographical standpoint, the greatest value went to North America, including Cuba, which absorbed $747,740, or 28 per cent of the total exports. Asia took the next greatest amount, with $589,220, or 22 per cent, closely followed by Europe, with $568,323, or 21 per cent. The islands southeast of Asia took 9 per cent, and the South American countries imported only 8 per cent.

METER EXPORTS FOR YEAR 1920

Canada	$488,568
Japan	441,075
England	237,572
Cuba	163,657
China	148,145
Brazil	131,621
Australia	111,458
Italy	101,554
Mexico	95,515
Spain	66,199
Argentina	65,828
Philippine Island	59,515
France	56,673
New Zealand	48,242
Netherlands	42,271
British South Africa	36,337
Belgium	34,751
Dutch East Indies	29,719
Denmark	29,303
Peru	27,668
Sixty other countries importing meters and measuring instruments	250,877
Total	$2,676,548

The accompanying list of countries shows only those which took in $25,000 and more of meters and measuring in-

struments, and the sixty other countries which imported American meters took a total of $260,877. These figures were compiled by the ELECTRICAL WORLD from data obtained from the Bureau of Foreign and Domestic Commerce, Washington, D. C.

Virtual Tariff Bill Passes British House of Commons

WHAT purports to be a tariff measure without being called such is the bill providing for the safeguarding of British industries which was passed by the House of Commons on Aug. 12. The bill was certified by the Speaker, since the House of Lords is powerless to amend it because of its being a money bill.

One of its clauses, it is said, provides for the levying of a customs duty of 33⅓ per cent ad valorem on importations entering the United Kingdom of optical glass, optical instruments, scientific glassware, porcelain instruments, magnetos, tungsten and its products, synthetic and organic chemicals, except dyestuffs; colors, coloring matters and fine chemicals.

Another clause provides for duties on any articles not mentioned which the Board of Trade under the act will have the power to specify on the ground that the said articles are being sold or offered in the United Kingdom at prices below their production, or, owing to exchange depreciation, at prices below what they can profitably be produced for in Great Britain.

Better Tone in Switch and Socket Market

MANUFACTURERS of wiring devices interviewed last week by a representative of the ELECTRICAL WORLD uniformly agreed that the low point in the trade depression has now passed and that a gradual improvement in market conditions may be expected to continue during the coming months. Not only are inquiries increasing considerably in volume but also actual orders are showing a tendency to increase. One of the leading Connecticut producers of wiring devices said that the jobbers in his section of the country are now ordering from thirty to sixty days' supplies in switch and socket products, which is a very favorable indication of improving conditions. This plant has gone upon a schedule of five days per week within a few days past and expects to dispose of its higher-priced raw material through production within the next three or four months. Another manufacturer has adopted a four-day week after a rather protracted run at three days. The annual fortnightly vacation shutdown is in process at another large establishment, and another producer is awaiting expansion in the building field before pushing his output to higher levels; but by and large the volume of domestic trade is clearly improving.

Manufacturers who briefly commented on the recent price movements in this field pointed out that a fairly stabilized condition has now been reached. Opinions differ as to the effect of these late downward movements on orders. None held that the reductions established caused any boom in sales, but several agreed that jobbers are disposed to order more freely now that prices are easier. The opinion was vigorously affirmed that prices are sufficiently stable now to warrant reasonable buying for expected needs of the next few months. It has been pointed out that the cost of wiring devices is a very small percentage of the total expense of building, and it is widely believed that, electrically speaking, it is time to go ahead on necessary construction without waiting for further price changes which would make but little difference in the ultimate cost of jobs. One manufacturer pointed out that his prices are now on the level of Jan. 1, 1916, and while foreign business is greatly hampered by the exchange and credit situation, the domestic output is expected to show a further decided gain next month.

Stocks are sufficient to make deliveries very easy on almost all standard lines. One factory reports filling seventy-six out of eighty items on a recent order from stock. Another has probably $400,000 in finished product ready for shipment on demand. Even those factories which do not make a practice of carrying large stocks are in a position to respond at once to increased demand through the utilization of the extra facilities put in during the war. The schedule-material maker is in a strong position to meet the requirements of a boom in building should one develop. Labor is more efficient, sales organizations are on their toes for business, jobbers are buying more consistently, raw material has been pretty well reduced in volume, and prices are lower than for some time. Improved banking conditions are telling of better credits, and there is ground for real optimism in viewing the future of this branch of the electrical industry.

Lower Prices Recorded on Cast Iron Conduit Bodies

NEW discount schedules of from 5 per cent to 13 per cent additional discounts on cast iron conduit bodies such as condulets, v.v. fittings, taplets, unilets, etc., were announced this week. The value of the order and its quantity as relates to standard package units are considered in the new prices.

Formerly orders in less than one-fifth standard package lots were sold at list prices; on one-fifth standard package lots 5 per cent was allowed, and on standard packages and over the discount was 15 per cent. The new schedule provides that on orders for quantities totaling less than $15 list price a discount of 5 per cent will be allowed on less than standard-package lots and 15 per cent on standard packages. Orders totaling $15 but less than $100 list price are discounted 10 per cent for less than standard package and 20 per cent for standard packages. Orders amounting to $100 and over receive a discount of 20 per cent for less than standard packages and 28 per cent for standard packages.

Metal Market Situation

THE copper market presents a stronger tone, particularly as producers are quite unwilling to sell any large amounts at the prevailing price of 12 cents for spot and August, delivered. This is said to be below production cost in most cases, but producers feel that this level will not hold much longer. There is especially little desire to sell to traders at this figure to hold for a better market. Inquiries are being received from consumers in much larger numbers than heretofore, showing a feeling out of the market to care for returning business. For September 12.25 cents a pound is the producers' quotation, although 12.12½ will be taken.

The Copper Export Association on Aug. 15 is reported to have paid off its Series A notes, due Feb., 1922, in an amount of $1,000,000. It is said the funds for the transaction came from sales of copper abroad.

Lead price is holding officially at 4.40 cents, but the outside market is 4.45 cents for prompt. Buying is fairly active. Slightly higher figures are being quoted in the scrap copper and brass market, but not because of any heavier buying.

NEW YORK METAL MARKET PRICES

	Aug 9, 1921	Aug. 16, 1921
Copper	£ s d	£ s d
London, standard spot	70 0 0	69 17 6
	Cents per Pound	Cents per Pound
Prime Lake	12.00	12.25
Electrolytic	12.00	12.00
Casting	11.37½	11.50
Wire base	13.50—14.00	13.50—14.00
Lead, trust price	4.40	4.40
Antimony	4.60	4.55
Nickel, ingot	41.00	41.00
Sheet zinc, f. o. b. smelter	10.00	10.00
Zinc, spot	4.75	4.70
Tin	27.75	26.12½
Aluminum, 98 to 99 per cent	24.50	24.50

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	9.50— 9.75	9.50—10.00
Brass, heavy	4.25— 4.50	4.50— 4.75
Brass, light	3.50— 3.75	3.75— 4.00
Lead, heavy	3.25— 3.37½	3.25— 3.37½
Zinc, old scrap	2.00— 2.25	2.00— 2.25

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

WHILE virtually every district reports a spotty condition of the electrical jobbing industry, the New York territory reports a noticeable improvement in orders and Portland and Spokane also show some improvement. In New York the buying seems to be less spasmodic and on a better weekly level. Inquiries are on the mend in general and are making much work for motor sales departments. There is better activity in short line extensions of utilities in the Middle West and in the South.

Conditions are improving fundamentally. In the South residence building is keeping up a good movement of construction materials; agricultural communities are in better condition in St. Louis districts; the live-stock situation in the Intermountain region is improving and money is slightly easier; textile, rubber and shoe industries in New England are working well. Building in New England is holding up well but has not come to the electrical stage. Strikes in the building fields in San Francisco are upsetting, but still some building is going on. Range and water-heater sales are good there. In the Northwest lumber and coal are moving quite well and the wheat harvest is satisfactory. Collections are holding their own throughout the country.

Secretary of Labor Davis estimates 5,735,000 unemployed at this time in the United States.

NEW YORK

Without doubt there is a noticeable improvement in the general condition of the electrical trade in this territory. Business, which three weeks ago flared up for one or two days a week and then flattened down to almost nothing, has steadied to a more continuous flow of small to moderate-size orders. Jobbers who were very skeptical about the possible return of activity prior to the fall report that their sales are showing increases from week to week.

The demand for materials for residential wiring continues and is being augmented by additional requirements for new business buildings and a certain amount of industrial work. A number of new buildings are coming into the electrical stage and other construction work is now under way and will be ready for the wiremen during the fall. Further inquiries for material for new construction work continue to come in, and the sale of small motors of from 5-hp. to 20-hp. shows signs of renewed activity.

Collections cannot be termed "good," but few of the electrical credit men report excessively long collections. These conditions in the electrical trade seem to be much better than in some other trades and industries which virtually have been at a standstill for the last six months. Furthermore, a good many of the accounts which are difficult to collect were contracted by industries whose plants have shut down during the period of depression.

Conduit.—Prices remain virtually unchanged since last week. In 2,500-ft. lots ½-in. black is quoted at $55 to $58; ¾-in., $74 to $77; 1-in., $105 to $106.76. Galvanized pipe in the same sizes is as follows: $62.75, $81.50 and $116.96. Stocks are fair and well distributed and immediate shipments can be made. Demand continues to be steady, although sales are mostly in small quantities.

Flexible Armored Conductor.—Demand continues to be fairly active in small quantities and stocks are good. The price for No. 14, two-wire, single-strip remains at $48 per 1,000 ft.

Rubber-Covered Wire.—Stocks are good and the demand for rubber-covered is steady. Sales are usually in small lots covering immediate requirements. No. 14 rubber-covered was quoted this week at $6.50 to $6.77 per 1,000 ft. There does not seem to be much inclination to cut prices on this material, and an advance in price is looked for in some quarters.

Non-Metallic Flexible Conduit.—Demand is small in this territory, and stocks are only sufficient to meet occasional orders. In 1,000-ft. lots prices quoted this week are for ⅜-in. size, $21 to $22; ½-in., $23 to $24, and ¾-in., $36.

Outlet Boxes.—Stocks are good, while demand is light and erratic. Price cutting on this material, which was in evidence a few weeks ago, is not so keen and discounts are holding at 50 per cent on black boxes and 45 per cent on galvanized.

Heating Appliances.—There have been no changes in the market conditions or prices of heating devices during the past week. Dealers are not inclined to place orders for their fall requirements until later, although at this time there does not seem to be any likelihood of another drop in prices.

CHICAGO

There has been little perceptible change during the past week, unless a comparative absence of price decreases may be considered something new. There still exists a vague feeling of optimism, but very few continue to predict much of a resumption of business this fall, as was the general expectation in the spring.

Jobbers report that practically every line is moving slowly. In the appliance line this merely reflects the comparative dearth of retail buying. Fortunately there has been a flurry of inquiries for transmission-line supplies and equipment, and jobbers are depending on orders of this sort to bring their sales volume up to a satisfactory total. Sales for July barely held their own with those of June, according to several large distributers, and are below those for last year, though fan orders were extremely heavy.

Flexible Armored Conductor.—Small orders were received by jobbers in unaccustomed volume for several days after the announcement of a price cut of about 10 per cent. The activity was not sustained, however, and sales have again dropped to a minimum set by immediate requirements. Jobbers are still well stocked and are placing only meager orders with manufacturers. No. 14, two-wire, single-strip is quoted at $48 per 1,000 ft. in 5,000-ft. lots.

Lamps.—Sales have begun to pick up and dealers and distributers who have had large stocks for some time are more hopeful. The demand should increase steadily from now on, however. The movement of the large sizes of gas-filled lamps is showing the growing tendency to substitute them for the arc lamps even in smaller cities.

Wire.—Prices have not changed during the past week, but show indications of stiffening, which may be ascribed to better inquiries rather than to better orders. Contractors' housewiring needs are easily supplied, and while central-station purchasing agents seem to be doing considerable shopping around, they are not placing many orders yet. No. 8 bare is quoted at 15 cents per lb. in 1,000-lb. lots.

Poles.—Jobbers have comfortably large stocks and there seems to be little opportunity of moving them this fall. Transmission-line requirements have come into the market more in the last month than in June, but the demand still falls considerably short of the supply. Judging from the size of the average individual order, the maintenance and short extension work going on is about normal with most central-station companies in the Middle West, but this class of work takes only a small proportion of the supply. A representative price is $13.90 for the Western cedar 35-ft. pole, 8-in. top.

Insulators.—Both glass and porcelain insulators are in fairly good demand, and jobbers are usually able to take care of orders out of stock. Prices remain steady.

Cross-Arms.—There has been a brisker market during the past two weeks, unaccompanied by price changes. Railroad buying has been more noticeable while central-station business is holding up well. Inquiries are improving.

BOSTON

Jobbers report uneven trade from day to day, with increased inquiries and general agreement that improved business is close at hand. Prices held firm last week in most lines. Buying from manufacturers is dull, local stocks meeting present needs in the main. Collections are little changed compared with last week. July trade was better than June's in several distributers' establishments. Building and engineering contracts in New England for the week ended Aug. 9 totaled $4,993,900 against $4,617,000 for the corresponding week last year. This total has been exceeded in but three years since 1900. Wiring-device factories in Connecticut have in some cases lengthened their weekly hours of production by 25 per cent in response to somewhat better buying by distributers in various parts of the country. Textile, rubber and shoe manufacturers report better business.

Motors.—Inquiries are more active among local distributers. Stocks are ample with occasional exceptions and prices are firm.

Industrial Electric Trucks.—Inquiries are more active than formerly, and while sales are dull the resumption of manufacturing operations or a larger scale renders the market more hopeful.

Rigid Conduit.—Pipe is moving in moderate quantities. Representative prices Monday were as follows: Galvanized, ½-in., $63 per 1,000 ft.; black, $57.90; galvanized, 1-in., $117.55 per 1,000 ft., black, $107.35, all in 2,500-lb. lots.

Lamps.—A vigorous trade in 21-cp. gas-filled automobile headlight lamps continued last week to meet the new regulations.

Porcelain.—Moderate sales are reported, with easy prices. Three-inch tubes sold Monday at $5.50 per 1,000 in barrel lots, two-wire and three-wire unglazed cleats at $12.50 per 1,000 in barrel lots, and "Nail-it" knobs at $17.50 per 1,000 in barrel lots.

Washers and Cleaners.—Better business than in early summer is reported and, while nothing like a rush is on, a good fall trade is anticipated. In this field very energetic sales efforts are reaping their due reward.

Flexible Armored Conductor.—Wiring jobs are absorbing this material in fair lots, considering the building trade's slow advance toward normal. No. 14 double-strip sold at Boston the first of the week at $50 to $52 in 2,500-ft. lots.

Wire.—Despite some tardiness in the construction field which holds back the movement of wiring materials, a better feeling is apparent in the wire market. No. 14 rubber-covered wire sells around $6.50 per 1,000 ft. in 5,000-ft. lots. A slight tendency toward stiffening prices is evident in copper circles.

Fans.—Cooler weather has slowed down fan sales sharply, following very satisfactory movement. Stocks are not exhausted, but are much lower than a few weeks ago.

ATLANTA

Jobbers are finding business rather spotty, one week showing a healthy activity followed by a week of stagnation; but, taking the situation as a whole, conditions are undoubtedly considerably improved over those of the past few months and little pessimism regarding the future is to be found. Business is of a more healthy tone; that is to say, the orders being received are for the more standard lines that the jobbers have in stock, whereas a few months ago a large number of the orders received called for shipments from factory. This state of affairs is enabling jobbers to reduce their stocks of standard material. The heavy building boom that is evidencing itself in all of the large cities is serving materially to reduce non-employment and is stimulating the lumber, wholesale hardware and electrical jobbing business, although as yet no general activity in heavy industrial construction is in evidence. The industrials have not in a large way entered the active market, though inquiries are on the increase, most of the purchases at the present time being made by the smaller contractors, central stations and municipal plants. Collections have again become very unsatisfactory owing to the inability of the rural merchants to make collections from their retail trade.

Lamps.—The dullness in industrial lines is reflected in the lamp market, sales being 16 per cent below those of last year, but the revival for fall demand is evidencing itself in the increased sales of incandescent lamps.

Service Boxes.—A reduction of 15 to 20 per cent has been reported in the price of black and galvanized service boxes. The demand for these has held up very well throughout the depression. Jobbers' stocks are well filled and factories are giving prompt deliveries.

Portable Lighting Fixtures.—Price reductions are noted in a number of different types by manufacturers of commercial lighting fixtures and portable types, but the demand is somewhat stagnant. Dealers' and jobbers' stocks are in fairly good shape.

Safety Switches.—The demand continues active and one manufacturer has reduced his price this week approximately 8 per cent. Prompt deliveries are being made from jobbers' stocks and all sizes are shipped promptly from factory.

Wire and Cable.—One manufacturer has reduced his base on weatherproof ½ cent this week, but at the present time the demand is very sluggish. Rubber-covered is comparatively active, however, and the market price is a little unstable. Several good orders were placed this week for bare stranded wire at price slightly below the market. All orders for heavy cable and bare wire are snapped up at low prices with very prompt delivery promised.

Poles and Pole-Line Hardware.—There is some activity in pole-line hardware and insulators for short extensions, and it is anticipated that good business will be transacted this fall if the many inquiries now out materialize in actual construction. There has been no reduction in the price of poles or pole-line hardware for the past three weeks. Prompt deliveries can be had on this class of material. Glass and porcelain insulators are being sold at prices slightly shading the market.

Portable Drills.—Manufacturers' agents and jobbers report awakened interest, particularly within the past six weeks, the stagnation prior to the month of July having given away to considerable activity in this line. Most inquiries are coming from the smaller industrial plants with a moderate volume of inquiries from more active automobile lines. Stocks are on hand in reasonable quantities in popular sizes.

ST. LOUIS

Very little change could be noticed in the business situation here last week. Jobbers report that it is spasmodic, brisk days alternating with dull ones, and that the sum total is about the same as a month or two ago. One jobber, however, reports a slight decline in billings. Manufacturers, with the exception of the shoe industry, are operating, if at all, on a materially reduced basis. The shoe factories are operating at about full force. Some gray-iron foundries are on a basis of from 25 to 50 per cent of normal. Malleable and steel foundries are exceptionally quiet.

Some large power-plant apparatus is being sold to the municipalities. The sale of a large turbo-generator outfit to a Missouri city was reported last week, as was also a good sized sale of boilers to an educational institution in Kansas. Immediate construction work, both residential and industrial, shows a tendency to decrease, but it is noticed that the industrials are increasingly formulating plans for enlargements or for new plants. Sales of appliances are falling off except where stimulated by special campaigns or by substantial price reductions.

Recent reports from the state board of agriculture indicate that the amount of grain raised this year will be slightly less than that of last year. Nevertheless, the condition of the agricultural communities is reported to be improving, and it is felt that credit conditions will be better this fall. Collections by the jobbers remain on an average basis of sixty days.

Porcelain.—Ten per cent lower prices have obtained since Aug. 2. "Nail-it" knobs, in barrel lots, now sell at $17 to

$18.50 per 1,000, two-wire cleats at $15 per 1,000, and ⅜-in. x 2½-in. tubes at $5.90 per 1,000. Only a moderate demand is found and stocks as a rule are in line.

Flashlamps.—Normal sales are reported and stocks are inclined to be low. A representative quotation on a three-cell nickel lamp is $1.15 and on a two-cell lamp it is $1. Batteries are finding a fast movement and low stocks prevail.

Lamp Cord.—Slow movement is still experienced. No. 18 cotton-covered remains at $13 per 1,000 ft. in 5,000-ft. lots, and silk-covered varies from $23 to $26 per 1,000 ft.

Magnet Wire.—A slight reduction is announced, the new prices being founded on a base of 16 cents per pound. There is no movement worthy of mention and stocks are abnormally heavy in most instances.

Dry Cells.—A steady demand, approximately normal, is reported by all jobbers. The regular cell is quoted at 31 cents by a representative jobber and the igniter at 32 cents.

Tape.—The demand for both friction and rubber tape is reported to be fairly good and low stocks are found in a number of instances. In 100-lb. lots the friction is selling at 38 cents per pound and the rubber at 36 cents.

Conduit.—Slow movement continues, though there was slight improvement immediately following the termination of the electrician's strike in St. Louis. Stocks are reported in good shape. The ½-in. black is quoted at $5.85 per 100 ft. and ½-in. galvanized at $6.37 per 100 ft., both in carload lots.

Conduit Elbows and Couplings.—A reduction of nine points in the discounts is just reported. Stocks are slightly heavy and the demand is quite dull.

Wire.—Owing to conservative buying, stocks of many jobbers in No. 14 rubber-covered are quite low, and in fact that of one large jobber is entirely exhausted this week. Sales continue in about the same volume as has prevailed for the past two or three months. No. 14 rubber-covered is quoted at $6.40 per 1,000 ft. in 10,000-ft. lots. Some variation from this price can be found, depending upon the desire of the individual jobber to move stocks. Weatherproof is being quoted on a 14½-cent base and bare copper wire at a base of 14 cents.

SAN FRANCISCO

The builders' strike has reached a new stage because virtually all the unions involved have elected representatives who have repudiated the former union officials and have counseled a general strike. Employers report that more and more men are working, although building is still but a small fraction of normal. Some local freight rates have been reduced because of auto truck competition. Collections are slightly better than they were last month, but a big factor in the present electrical financial situation is the big stocks which have accumulated with the dealers.

Schedule Material.—An intensive drive is being made on fuses, for which contracts are being taken on refilled types. Rather good sales are reported especially to dealers who specialize in regular customers. Prices are low, but as still lower prices seem to be expected orders are in the smallest quantities possible to earn fair discounts.

Ranges.—The Great Western Power Company is staging a considerable campaign on the larger energy-consuming devices such as electric ranges, large radiators and water heaters. The rate is very good. There is a flat water-heating rate which averages about $3.50 per family per month. About 100 ranges have been marketed in the last two months, but with increased crews and more distributing centers better business is expected. The devices are sold at actual cost and easy terms of payments are granted on request.

Household Devices.—During the past week business on sewing machines and vacuum cleaners has noticeably increased. Although washers are still moving slowly, very few sales campaigns are being waged, and it is felt that a few permanent employees steadily pushing household appliances are far better for the dealer in the end than the clean-up type of sales crew. Such crews have really giver the business in this section a black eye.

SEATTLE—SPOKANE—PORTLAND

Although Seattle jobbers report no noticeable improvement in the electrical business over last week, nevertheless in other quarters some increased activity is noticed, indicating a slight upward trend. Some movement in lumber is again being felt, largely as a result of Japanese demand. The total volume of new business, however, is relatively small, and the orders booked are on an unprofitable basis. Yet the mills are operating at 71 per cent of normal, in order to keep them going and supply their men with work. Coal operators in western Washington, whose properties have been tied up since March 15, have again commenced operation, this time on an open-shop basis. Collections are still on a forty-five-day to fifty-day basis. Buying is largely from hand to mouth and seems to be governed by immediate necessity only. Lamp-cord stocks are ample and demand is very moderate. Schedule materials have suffered no price change. In the past two weeks, with the exception of shade holders, which are down 15 per cent, demand is moderate and stocks are all in good shape.

More inquiries for quotations and increased sales have given Spokane jobbers much satisfaction and caused a brighter outlook during the last week and continued improvement is looked for during the fall months. Prices are weak, with slight drops reported on wire and conduit and a 50 per cent cut in porcelain. Collections are still slow and are not expected to improve materially until the harvest is further along and wheat money begins to circulate. Stocks are in good shape and deliveries prompt. Altogether, dealers are feeling better than in a long time. Wheat, in those districts where the harvest is under way, is averaging well and sustaining the estimates made, which will give a bumper yield. This makes for a much better feeling, though the actual results are not yet in evidence.

Portland jobbers report an appreciable increase in business during the past week, principally from the country districts. Considerable activity has been shown in the sale of ranges, washing machines and mangles. Another slight decline has been noted in the price of appliances. Collections and credits remain unchanged. Contractors for large wiring work report prospects to be improved, and there is more optimism felt than for some time. There will undoubtedly be a decrease in wages Sept. 1. Dealers report the volume of business to be the same or possibly a little slower. There is much keener activity in residence wiring than formerly and the number of permits being issued is somewhat decreased. The number of electric wiring permits issued for the month of July was 1,007, with a valuation of $123,436.

SALT LAKE CITY—DENVER

The employment situation has shown marked improvement in the past few weeks, seasonable occupations having done much to relieve the widespread condition of enforced idleness. The home-building boom that has been more or less successfully launched in the larger cities of the Intermountain West has given work to thousands of artisans, and electrical contractor dealers are also beneficially affected. Much interest centers in the question of rates affecting the shipping of live stock and farm produce grown in the mountain region. Nothing at present could be a greater boon than a material lowering of the freight schedule. Pending the adjustment, however, farmers are showing a tendency toward immediate marketing of their grain.

A slight easing of the money market is the first and most salutary result. The live stock situation is much improved as a result of available loans through the operation of the Stockgrowers' Finance Corporation. Lambs are moving to market at a lively rate and bringing usually a satisfactory price. This will help the sheepmen through their worst straits. There is little change in the credit situation and collections continue slow.

Wire.—Insulated wire has recently taken a 5 per cent advance in price. The increase is due to the fact that many jobbers have used up their stocks purchased in job lots and are now buying on the market again. Bare wire is still in small demand and the price remains down.

Conduit.—Stocks are heavy and demand is light. The ½-in. galvanized is now selling at $8.35 per 100 ft.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

September Meetings of Supply Jobbers' Association

Announcement has been made of the late summer meetings of the Electrical Supply Jobbers' Association. On Sept. 19 the committee on committees will meet in Buffalo, and on Sept. 20 and 21 the executive committee will meet in the same city. Sept. 22 has been scheduled for the Atlantic Division meeting at the Bellevue-Stratford in Philadelphia, while the Central Division will take the two days of Sept. 22 and 23 for its conference in Chicago.

Copper and Brass Companies Join to Stimulate Sales of These Products

About thirty copper, brass and copper-alloy interests on Aug. 9 formed the Copper and Brass Research Association, an unincorporated, voluntary organization.

The purpose of the organization is to stimulate by co-operative effort the use of copper, brass and copper-alloy products. Membership is open to producers of copper sold here or selling agents of copper in the United States; to fabricators of copper, brass and copper products generally in the United States and in Canada, and to others directly engaged in or connected with the copper and brass industries. R. L. Agassiz, president of the Calumet & Hecla Mining Company, is president; Fred S. Chase, Chase Rolling Mills Company; C. F. Kelley, Anaconda Copper Mining Company, are vice-presidents; W. S. Eckert is secretary, and William A. Willis is manager of the association. Membership of the copper wire and electrical equipment manufacturers are, for the most part, conspicuous by their absence.

Dealers Use Maker's Showroom for Prospective Customers

The Beardslee Chandelier Manufacturing Company, as a means of working with dealers, is urging them to make use of its showrooms at 216-220 South Jefferson Street, Chicago, for prospective customers seeking lighting fixtures. Realizing that the average dealer cannot carry a large stock of fixtures, the company has issued two cards for the use of dealers. It is figured that a large customer within 250 miles of Chicago will probably have need to go to that city occasionally, and one of these cards is made out by the dealer as a card of introduction to the company, so that the customer may have access to the thirty-five thousand-dollar stock of fixtures carried in the Chicago showrooms. The reverse of the card shows the store in relation to hotels, depots, etc.

The other card is to enable the dealer to notify the Beardslee company that he has given one of the introductory cards to one of his customers. The system is working well.

R. A. Lundquist to Head Electric Machinery Division

Announcement has been made by the Department of Commerce of the appointment of R. A. Lundquist of Minneapolis to take charge of the newly created electrical machinery division in the Bureau of Foreign and Domestic Commerce, made possible by Congress through the export industries act. It is planned to obtain the services of other engineers to assist Mr. Lundquist, who himself is an electrical engineer of wide experience and a graduate of the University of Minnesota.

Second Quarter Sales Report of Allis-Chalmers

For the second quarter of the present year sales billed by the Allis-Chalmers Manufacturing Company, Milwaukee, amounted to $7,014,373, which is less than 10 per cent smaller than sales billed over the first quarter. Net profit after provision for federal taxes in the second quarter came to $635,880, while for the first quarter it was $774,189. Unfilled orders on hand as of June 30, 1921, aggregated $9,472,772, as against $12,943,633 on March 31.

Pacific States Electric Is Coast Hotpoint Distributer

The Pacific States Electric Company, has been appointed Pacific Coast distributer for Hotpoint electric appliances and Hotpoint-Hughes electric ranges. Complete stocks of these appliances and ranges will be carried at the company's warehouses in Los Angeles, San Francisco, Oakland, Portland and Seattle, and at these points sales service also will be maintained.

Thoner & Martens Issue First Catalog

Thoner & Martens, 468 Commercial Street, Boston, manufacturers of disconnecting switches, heavy-duty switches, etc., recently issued their first catalog. This publication contains twenty-four pages, covering the different types of disconnecting switches, heavy switches, and T. & M. switch locks manufactured by the company. The firm also specializes in power-station apparatus and installation.

Westinghouse Lamp to Issue Series of Practical Lighting Bulletins

Arrangements have been made by the Westinghouse Lamp Company, 165 Broadway, New York City, to compile and issue a series of semi-technical bulletins on the subject of illumination and the proper uses of artificial light. These booklets will deal with important features of illumination, such as lighting intensities, the illumination of retail stores, cleaning and maintenance, paints and painting for light, residence lighting, illumination calculations and the lighting of various industries. They will treat of only the practical usage of light, based upon the accumulation of facts by well-known authorities and supplemented by large amounts of original research data not heretofore published. The first of the series, bulletin E-100, entitled "The Foot-Candle Meter," has been issued and gives instructions for measurements of illumination. A cabinet or container will be issued with one of the later bulletins in which the complete set may be kept.

Western Union Issues $15,000,000 Fifteen-Year Gold Bonds

The Western Union Telegraph Company has issued and sold $15,000,000 in fifteen-year 6½ per cent gold bonds, due Aug. 1, 1936, in denominations of $1,000 and $500. The purpose of the issue, according to a statement from President Carlton, is to reimburse the treasury of the company for expenditures made on account of extensions, additions and improvements to its plant and equipment (outside of the State of New York) and to provide funds for further extensions, additions and improvements (outside of that state). The issue was sold directly the books were opened.

Cushman Electric Company in New Hands

A newly organized company, consisting of Garrett M. Ross, president; A. L. Cushman, vice-president, and Alexander P. Achimore, manager, has recently purchased the machinery, tools and fixtures of the Cushman Electric Company, Concord, N. H., and is operating the plant. The old company name remains, and under that name Mr. Ross is in charge of the New York City office at 255 Greenwich Street. The special products of the company are motors for typesetting machinery and motor-generator sets for telegraph use. Mr. Cushman will continue in the design of the motors. Mr. Achimore was formerly a power engineer with the Western Union Telegraph Company.

Japan Orders Two Locomotives from Westinghouse

Official announcement has been made by the Westinghouse Electric International Company that an order has been received from the imperial government of Japan for two 62-ton freight electric locomotives, these locomotives to

operate around Tokyo. They are the standard box type, 42-in. gage, and are to operate on 1,200 to 1,500 volts direct current, with overhead-line equipment, multiple-unit control, containing four motors of 250 hp. each.

These locomotives will be built at the East Pittsburg works by the Westinghouse Electric & Manufacturing Company, the work to begin at once and to be completed in one year.

Largest 60-Cycle Waterwheel Units Now Under Construction

In considering the largest 60-cycle waterwheel units ever built, which the Allis-Chalmers Manufacturing Company is constructing for the Mount Shasta development of the Pacific Gas & Electric Company, the weights of steel, iron and copper may be interesting. The rating of each generator is 35,000 kva., 11,000 volts, 60 cycles, three-phase, 257 r.p.m. Net weight of each generator with its exciter is estimated by the manufacturing company at 549,000 lb., while the raw materials used in each generator consist mainly of cast iron, 151,700 lb.; cast steel, 189,300 lb.; forged steel, 24,600 lb.; punchings, 148,000 lb.; copper, 46,000 lb., and miscellaneous, 10,700 lb.

Westinghouse Company Installing Interworks Radio System

The Westinghouse Electric & Manufacturing Company is arranging to demonstrate on a large scale one of the important commercial uses of radio apparatus by installing an interworks system of wireless telegraphy and telephony. Factories at East Pittsburgh, Pa., Newark, N. J., Bloomfield, N. J., Springfield, Mass., South Philadelphia, Pa., Cleveland, Ohio, and elsewhere have been, or will be, equipped with high-powered transmitting and receiving sets, and it is expected that much of the pressing correspondence between these factories will be conducted by means of this system in the near future.

Several of the stations, notably those at East Pittsburgh, Cleveland, Springfield and Newark, are already in operation. The East Pittsburgh station (KDKA) has become well-known to all wireless operators (professional and amateur) because of its nightly broadcasting of concerts, addresses, church services, government agricultural reports and other interesting radio-phone messages.

The company's offices adjacent to these stations may in time be linked into this system, and it is possible that in the not very distant future all of the offices may be communicating with those within operating range by means of wireless telephony.

The American Wiremold Company has established a sales office at 71 West Twenty-third Street, New York City, under the direction of C. W. Abbott, vice-president and general sales manager. The headquarters of the company will continue to be maintained at its factory in Hartford, Conn.

The M. H. Detrick Company, 155 East Superior Street, Chicago, manufacturer of the Detrick arches and the Detrick-Hagan steam-jet ash conveyors, announces the appointment of H. W. Thompson, 503 Mining Exchange Building, Denver, as its sales representative in that territory.

The Triangle Conduit Company, Inc., 50 Columbia Heights, Brooklyn, N. Y., announces that Thomas H. Bibber has been appointed general manager of the company's Western business. In addition to his new duties Mr. Bibber will continue to handle the production and sale of "Tri Cord."

The Multi Electrical Manufacturing Company, 703 Fulton Street, Chicago, announces that A. C. Walton is now located at 500 Fifth Avenue, New York City, where a complete line of "Multi" porcelain cartridge fuse cut-outs is displayed.

The Cutler-Hammer Manufacturing Company, Milwaukee, announces that its Cincinnati office has been removed from the Dwywne Building to the Dixie Terminal Building. A. R. Maujer, formerly of the sales-engineering force of the Pittsburgh office, is now in charge of the Cincinnati office.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

A mercantile company in India (No. 35,286) desires to secure the representation of manufacturers for the sale of electrical goods, railway supplies, etc.

A commercial agency in England (No. 35,308) desires to secure the representation of firms for the sale of wire ropes, cables, electrical fittings, machine tools, etc.

An agency is desired by a commercial traveler in Canada (No. 35,339) for the sale of tools for machinists, electricians, etc.

TENDERS FOR ELECTRIC EQUIPMENT FOR DURBAN, SOUTH AFRICA.—Tenders will be received at the office of the town clerk, Durban, South Africa, until Sept. 28, for furnishing two 500-kw. rotary converters, switchgear and automatic controlling devices and a small quantity of high-tension supply feeders. Specifications are on file at Room 49, Department of Overseas Trade, 35 Old Queen Street, London, S.W.1, England.

EQUIPMENT FOR ELECTRIC PLANT FOR COVENTRY, ENGLAND.—Tenders are invited by the chairman of the electricity committee, Council House, Coventry, England, until Sept. 1, for furnishing and installing at the proposed new generating station, Longford, near Coventry, the following machinery: Two 10,000-kw., three-phase turbo-alternators complete with condensing plant; four water-tube boilers, complete with chimneys, superheaters, mechanical stokers, economizers and all accessories. George E. Tough is engineer and manager.

INTERNATIONAL FAIR TO BE HELD IN PRAGUE, CZECHOSLOVAKIA.—Official announcement is made of the Third International Fair to be held in Prague, Czechoslovakia, from Sept. 1 to Sept. 8. The products to be shown will be classed in eighteen groups, including building and metal trades, electrical and mechanical goods, etc.

NEW ELECTRIC POWER PROJECTS IN JAPAN.—Plans are under way, according to *Electrical Industries*, to organize the Abukumagawa Hydro-Electric Company and the Tokyo Electric Transmission Company. The former will have a capital stock of 10,000,000 yen, and it proposes to build a hydro-electric plant on the Abukuma River, Fukushimakin, to develop 55,000 kw., while the latter will be capitalized at 30,000,000 yen and will supply its power to Tokyo.

New Apparatus and Publications

ELEVATOR MOTORS.—The Ideal Electric & Manufacturing Company, Mansfield, Ohio, has issued a bulletin on its elevator motors.

INSTRUMENT SWITCHES.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has recently placed on the market its type RS instrument switches.

INDOOR CURRENT TRANSFORMERS.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has recently brought out an indoor current transformer known as type K, which is listed for ammeter, wattmeter and watthour-meter use.

METERS.—The Sangamo Electric Company, Springfield, Ill., is distributing a six-page leaflet covering its various models of meters.

PULVERIZED COAL.—"Catechism of Pulverized Coal as Applied to Boilers" is the title of an article published in the July, 1921, issue of *Fuller News*, published by the Fuller Engineering Company, Allentown, Pa. Company, Chicago, have issued catalog and

CONDUIT FITTINGS.—S. R. Fralick & illustrated price list No. 21, listing conduit fittings and wiring devices.

INSULATING MATERIAL.—The Diamond State Fibre Company, Bridgeport, Pa., is distributing a four-page leaflet describing its "Condensite Celoron" insulation for gears and radio equipment.

ELECTRIC OVENS.—The Despatch Manufacturing Company, Minneapolis, Minn., is distributing a revised price list applying to catlog 3 of its electric ovens, which went into effect Aug. 10, 1921, and supersedes all previous lists.

AUTOMOBILE CUT-OUT RELAY.—A new cut-out relay has just been added by the Westinghouse Electric & Manufacturing Company to its line of automotive products.

LABORATORY RHEOSTATS.—Beck Brothers, 3640 North Second Street, Philadelphia, are distributing catalog C-10, covering their "Becbro" laboratory rheostats.

DIRECTORY AND BUYERS' GUIDE.—"The *Engineer* Directory and Buyers' Guide" (No. 21) has been issued by the *Engineer*, Ltd., 33 Norfolk Street, London, W.C.2, England.

ELECTRICAL SUPPLIES.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is distributing its catalog of electrical supplies for 1921 and 1922. The book is cloth-bound, contains 1,311 pages and is thumb-indexed. A general outline of the company's industrial motors and controllers, railway equipments and power and marine machinery is also included. This catalog replaces all catalogs issued heretofore on details and supplies.

New Incorporations

M. J. GRUEBEL & COMPANY, 243 Palisade Avenue, West Hoboken, N. J., have been organized to manufacture and deal in electrical appliances. Michael J. Gruebel is head of the company.

THE WOODBRIDGE (N. J.) CONSTRUCTION COMPANY has been incorporated with a capital of $50,000 to install electric light, heat and power plants. The incorporators are Norman and Clarence Hoagland, 118 Barron Avenue.

THE NEW JERSEY STORAGE BATTERY MANUFACTURING COMPANY, Jersey City, N. J., has been incorporated by Daniel E. Lenthe and Andrew J. Weger, 26 Tyson Place. The company proposes to manufacture storage batteries and other electrical equipment.

WALSH & MEAD, INC., New York, N. Y., has been incorporated with a capital of $10,000 to manufacture electric motors and parts. The incorporators are W. R. Walsh, R. Mead and W. Smith. Wechsler & Kohn, 128 William Street, represent the company.

THE SOLAR ELECTRIC LAMP COMPANY, Danvers, Mass., has been incorporated with a capital of $50,000 to manufacture electric lamps, etc. The directors are Oscar R. Bodwell and Peter N. Wettlaufer, Danvers, treasurer.

THE KEMPTON ELECTRIC COMPANY, Topton, Pa., has been incorporated with a capital of $5,000 to operate a light and power system in Topton. D. S. Martin, Reading, is treasurer of the company.

THE A. L. NICHOLS MANUFACTURING CORPORATION, Poughkeepsie, N. Y., has been incorporated with a capital of $50,000 to manufacture electrical products. The incorporators are J. W. Allgaze and C. F. Malcolm, Poughkeepsie. F. E. Hamilton, 61 Broadway, New York City, is interested in the company.

THE GENERAL GAS & ELECTRIC COMPANY, Hanover, Pa., has been incorporated with a capital of $5,500 to operate an electric light and power system in Hanover. W. F. Kintzing is treasurer.

THE COALDALE POWER COMPANY, Riddlesburg, Pa., has been chartered with a capital of $5,000 to operate an electric light and power plant and system in Riddlesburg. John M. McIntyre is treasurer.

THE BLOOMFIELD STORAGE BATTERY COMPANY, Montclair, N. J., has been organized by William H. Cleland, 37 Cloverhill Place, and others to manufacture batteries and equipment.

THE BEAR CREEK (WIS.) ELECTRIC LIGHT CMPANY has been organized to operate an electric light system in the village of Bear Creek.

Record of Electrical Patents

Notes on United States Patents

(Issued Aug. 2, 1921)

1,385,979. ELECTRICAL MEASURING INSTRUMENT; Chester T. Allcutt, Wilkinsburg, Pa. App. filed March 2, 1917. Symmetrical rotating electrostatic fields.

1,385,980. CIRCUIT-INTERRUPTING DEVICE; Chester T. Allcut Wilkinsburg, Pa. App. filed Sept. 1, 1917. For automatically interrupting circuits under predetermined conditions.

1,385,981. SWITCH; James M. Brown, Fittsburgh, Pa. App. filed Oct. 8, 1917. To indicate selectively voltage of, or a ground on, any phase of polyphase circuit.

1,385,989. TERMINAL STRUCTURE FOR ELECTRIC RANGES; Frank F. Forshee, Flint, Mich. App. filed March 1, 1920. Busbar structure to which conductors may be connected.

1,385,995. VENTILATING APPARATUS; Rudolf E. Hellmund, Swissvale, Pa. App. filed Aug. 7, 1917. Prevents snow or ice from entering machine casing.

1,385,996. REGENERATIVE CONTROL SYSTEM; Rudolf E. Hellmund, Swissvale, Pa. App. filed Feb. 3, 1916. Control for dynamo-electric machines of commutator type.

1,385,997. SYSTEM OF CONTROL OF SINGLE-PHASE COMMUTATOR-GENERATORS; Rudolf E. Hellmund, Swissvale, Pa. App. filed Dec. 8, 1917. For governing motors of single-phase commutator type under regenerative conditions.

1,386,016. SYSTEM OF CONTROL; Hurd T. Morris, Wilkinsburg, Pa. App. filed June 4, 1915. For alternating-current motors of commutator type.

1,386,017. ELECTRODE-ADJUSTING MECHANISM; William L. Morris, Chicago, Ill. App. filed April 19, 1920. Electrode holders for electric furnaces.

1,386,031. ELECTRICAL MEASURING INSTRUMENT; Harold B. Taylor, Wilkinsburg, Pa. App. filed Feb. 4, 1918. Direct-current wattmeters used in connection with shunts.

1,386,045. ELECTRICAL REGULATORS; Walter R. Woodward, Wilkinsburg, Pa. App. filed Aug. 10, 1916. Vibrating-contact type employed for adjusting field excitation of dynamo-electrical machines.

1,386,076. OXIDATION AND COLORATION OF FERROUS SURFACES; Tito Rondelli, Turin, and Quirino Sestini, Bergamo, Italy. App. filed Aug. 24, 1920. Surface to be bronzed is electrolytically coated with iron.

1,386,094. ELECTROLYTIC APPARATUS; Herbert H. Dow, Midland, Mich. App. filed Sept. 3, 1918. For electrically treating natural brine.

1,386,095. ELECTRODE ELEMENT FOR GALVANIC BATTERIES AND METHOD OF PRODUCING SAME; Thomas A. Edison, Llewellyn Park, West Orange, N. J. App. filed Nov. 6, 1919. Improved negative electrode element for primary batteries.

1,386,150. RHEOSTAT; Derek S. Breitenbach, Washington, D. C. App. filed Jan. 21, 1920. Variable type has maximum ventilation.

1,386,155. ELECTRIC FURNACE; Walter S. Burch and William A. Schell, Rochester, N. Y. App. filed July 31, 1919. Manufacture of calcium carbide.

1,386,159. CONTROLLING SYSTEM FOR FEED MOTORS; G. Harry Case, Philadelphia, Pa. App. filed Oct. 7, 1914. For automatically controlling feed mechanism.

1,386,215. ELECTRIC WELDING SYSTEM; David H. Wilson, Paterson, N. J. App. filed Nov. 24, 1913. Automatic regulation of current.

1,386,231. ELECTRICAL IGNITION APPARATUS FOR INTERNAL-COMBUSTION ENGINES; Frederic Billon, Solothurn, Switzerland. App. filed Feb. 13, 1918. Rotor balanced statically, dynamically and magnetically.

1,386,234. CONTROL MECHANISM FOR FLUID AND ELECTRIC COUPLINGS; Thomas R. Brown, Sparkill, N. Y. App. filed May 22, 1914. For controlling train-line circuits.

1,386,244. METHOD OF TREATING BRINE; Herbert H. Dow, Midland, Mich. App. filed Sept. 26, 1918. To prepare brine for electrolysis.

1,386,287. APPARATUS FOR SEPARATING SUBSTANCES OF DIFFERENT DIELECTRIC CAPACITIES; Henry M. Sutton, Walter L. Steele and Edwin G. Steele, Dallas, Tex. App. filed Sept. 24, 1904. Producing dielectric hysteretic impedance in the material.

1,386,300. ELECTRIC HEATER; Charles A. Xardell, Utica, N. Y. App. filed Oct. 12, 1920. Self-regulating.

1,386,303. HEAT-CONDUCTING DEVICE; Percy A. E. Armstrong, Loudonville, N. Y. App. filed March 2, 1920. Hot-plate type.

1,386,321. TELEPHONE REPEATER EQUIPMENT; Charles S. Demarest, Brooklyn, N. Y. App. filed May 9, 1919. Means for testing repeaters.

1,386,326. TROLLEY-WIRE SPLICE; James J. Fisher, Junior, West Va. App. filed March 9, 1921. Particularly adapted for use in mines.

1,386,356. ELECTRIC HEATER; William E. Pasik, De Kalb, Ill. App. filed Jan. 19, 1920. Maximum amount of heat-radiating surface.

1,386,387. TYPEWRITING MACHINE; John Waldheim, Elizabeth, N. J. App. filed Sept. 22, 1919. Return of carriage and line-spacing by power-actuated means.

1,386,421. SWITCH OR RECEPTACLE BOX; William J. Newton, Lynbrook, N. Y. App. filed March 9, 1916. Means for securing box in position.

1,386,464. CIRCUIT-CONTROLLING TELEPHONE-RECEIVER SUPPORT; James B. Furber, Rahway, N. J. App. filed Nov. 1, 1919. Hook lever controlled by receiver.

1,386,474. FLASHLIGHT; Joseph Vince, Brooklyn, N. Y. App. filed June 26, 1920. Conductor removable with battery.

1,386,484. DISTILLING APPARATUS; Charles G. Adsit, Atlanta, Ga. App. filed Sept. 14, 1920. For cracking and distilling crude petroleum.

1,386,487. ELECTRICAL STEAM AND HOT-WATER BOILER; Nils R. Forssblad, Vasteras, Sweden. App. filed June 10, 1920. Steam produced by current passing between electrodes submerged.

1,386,525. ELECTRIC IRON; Jose A. Oca-Balda and Godfrey Alfred De Langie, New York, N. Y. App. filed Aug. 6, 1920. Means for permanently cutting off current when certain temperature has been reached.

1,386,566. GRAVITY TROLLEY RUDDER; Fred Graf, Lankershim, Cal. App. filed Dec. 30, 1918. Wheel automatically aligned with pole when out of contact with wire.

1,386,569. INCUBATOR AND BROODER; Oscar W. Herd, Tulare, Cal. App. filed May 27, 1920. Electric heating means.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

LEWISTON, ME.—Plans have been completed for placing wires of the Androscoggin Electric Company underground from the North Bridge to Hospital Square. O. D Mudgett is superintendent of the company

SKOWHEGAN, ME. — Bids will be received until Aug. 23 for the installation of an electric lighting system on the grounds of the State Reformatory for Women at Skowhegan. Plans and specifications can be seen at the office of the superintendent, Skowhegan.

NEW IPSWICH, MASS.—An appropriation of $20,000 has been authorized for the installation of a municipal electric light system in New Ipswich. Walter S. Thayer is a member of the electric light committee.

HARTFORD, CONN. — The Plimpton Manufacturing Company is considering extensions and improvements to its power house.

NEW HAVEN, CONN. — The United Illuminating Company has awarded contract for the construction of a two-story addition, 60 ft. x 65 ft., to its electric power plant on Grand Avenue, to the Standard Construction Company, 153 Court Street.

NEW HAVEN, CONN.—The installation of an ornamental lighting system on State Street between Chapel and Water Streets is under consideration.

Middle Atlantic States

BEACON, N. Y.—Application has been made by the Southern Dutchess Gas & Electric Company to the Public Service Commission for permission to erect an addition to its electric power plant near East Fishkill.

BROOKLYN, N. Y. — Plans have been completed by the Artistic Dyeing Company, 100 Jewel Street, for the construction of a two-story power house, 52 ft. x 68 ft., at Moultrie and Meserole Avenues.

CANANDAIGUA, N. Y.—Plans are under way by the Rochester Gas & Electric Corporation for the erection of a new transmission line to Canandaigua, a distance of 28 miles, to cost more than $200,000. Steel lattice-work poles will be used and as an additional support to the line fifty strain towers will be utilized. The plans also include the construction of a substation at Canandaigua and rebuilding the Canandaigua-Littleville transmission line to provide for an increase from 6,600 volts to 11,000 volts.

FILLMORE, N. Y.—Plans are under way by the Fillmore Electric Company, Inc., for the erection of a new transmission line from Belvidere to Friendship, with distribution system at the latter town for light and power service. The company has applied to the Public Service Commission for authority to operate.

GASPORT, N. Y.—The power house of the Wickwire Limestone Company was destroyed by fire recently, causing a loss of about $30,000.

GOUVERNEUR, N. Y.—The purchase of the Duzee water power site for development of electricity for light and power purposes is under consideration by the Village Board.

LAWRENCE, N. Y.—The Milling & Lighting Company, Brasher Falls, has applied to the Public Service Commission for permission to build an addition to its local plant. A franchise for the work has been granted by the Common Council of Lawrence.

NEW YORK, N. Y. — The P. Lorillard Company, 119 West Fortieth Street, manufacturer of tobacco, plans immediate construction of a four-story plant at Avenue A and Seventy-first Street, to cost, with equipment, about $500,000. Special machinery, transmission equipment, motors and other electrical machinery will be required.

NEW YORK, N. Y.—Bids recently received by the Delaware, Lackawanna & Western Railroad Company, 90 West Street, for electrical equipment for the operation of a section of its line in the anthracite district of Pennsylvania have been rejected. New bids, it is understood, will be advertised at an early date. Gibbs & Hill, Pennsylvania Terminal, are consulting engineers.

PATERSON, N. J.—Bids will be received by the Board of Education, Room 24, City Hall, Paterson, N. J., until Aug. 26 for furnishing material and completing work required for the installation of a system of electric lighting and bells in School No. 14. Lee & Hewitt, 152 Market Street, are engineers.

TRENTON, N. J. — The installation of street lamps on South Montgomery Street with underground conduit system is contemplated by the City Commissioners. The Public Service Electric Company serves the city.

TRENTON, N. J.—The installation of an electric lighting system consisting of about 1,000 lamps is under consideration by the Woodlawn Park Association in connection with amusement devices to be erected at Woodlawn Park.

ALLENTOWN, PA.—Plans has been approved by the City Council for extensions to the street-lighting system on Hamilton Street from Penn to Second Streets, and on South Eleventh Street from Hamilton to Walnut Streets.

HARRISBURG, PA.—The City Council is considering the construction of an addition to the municipal filtration plant at Island Park, to cost about $800,000. Considerable electrical and mechanical equipment will be required.

PHILADELPHIA, PA.—The Transportation Committee of the City Council has approved ordinances providing for the condemnation of land at Arrott Street and Letterly Street, where two power houses will be built by the city for the operation of the Frankford Elevated Railway. The additional power plants will cost about $900,000. Work is now under way at Fairmount Avenue on a power house also be used in connection with the railway.

PITTSBURGH, PA. — Preparations are being made by the North Pole Ice Company, Carson Street, for the construction of a one-story ice-manufacturing plant, 60 ft. x 100 ft., to cost about $50,000.

SCRANTON, PA.—The Delaware, Lackawana & Western Railroad Company, coal-mining department, Scranton, has awarded contract for the construction of a one-story machine and forge shop, 50 ft. x 200 ft., at its Storrs Colliery, to cost about $60,000, to the Industrial Construction Company, 514 Union National Bank Building. The company also plans to build a one-story addition to its coal-washing plant at this point to cost about $35,000, and an electric power station and engine hoisting house at the Bellevue Colliery.

SHENANDOAH, PA. — Extensions are under consideration by the Philadelphia & Reading Coal & Iron Company, Reading, to its high-tension electric transmission system in the vicinity of Shenandoah.

ANNAPOLIS, MD.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Aug. 31, Specification 4487, for construction of a coal bunker extension to power house at Annapolis, Md. Address chief of bureau.

GLEN WHITE, W. VA.—Plans are under consideration by the E. E. White Coal Company for the construction of a tipple at its properties. The company also contemplates the erection of a one-story power house with boilers equipped with automatic stokers.

WILLIAMSON, W. VA.—A company is being organized by Mark H. Russell and M. T. Perseger, with a capital of $1,000,000, to construct and operate a cold storage and ice-manufacturing plant in Williamson, for which plans are under way. Considerable electrical equipment will be required.

ALEXANDRIA, VA. — Plans have been prepared for the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the construction of a power house at Alexandria, Va.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing the following: Until Aug. 30, Norfolk, Schedule 8631 — 320 knife switches; Hampton Roads—4,000 link fuses and miscellaneous fuse elements. Until Sept. 6, Schedule 8637—miscellaneous quantity of electric cable and thirteen terminals; Schedule 8642—miscellaneous quantity of electric cable.

North Central States

DOYLESTOWN, OHIO.—The Doylestown Electric Light & Power Company, recently organized, has been granted a franchise to install a distributing system in Doylestown. Contract for the construction work has been awarded to the Collier Construction Company, 570 East 101st Street, Cleveland. H. C. Petit is president. Herbert C. Tinker, 771 Chalker Street, Akron, is engineer.

RANDOLPH, OHIO. — The Randolph, Suffield & St. Joseph Electric Light & Power Company, recently organized, is planning to furnish electricity in the villages of Randolph, Suffield and St. Joseph and surrounding territory. Contract for the erection of a transmission line has been awarded to the Collier Construction Company, 570 East 101st Street, Cleveland. J. C. Rogers is president. Herbert C. Tinker, 771 Chalker Street, Akron, is engineer.

LOUISVILLE, KY.—The Kentucky Utilities Company, it is reported, has secured a franchise to erect an electric transmission line to the Federal Sanatorium, now under construction at Dawson Springs. The franchise also permits the company to operate elsewhere in the same territory.

NOBLESVILLE, IND.—The N. O. Nelson Manufacturing Company, 928 Chestnut Street, St. Louis, Mo., is planning the erection of a power house at its local works in connection with the extensions to the enameling furnace and other parts of the plant. L. D. Lownin is president.

MATTOON, ILL.—The proposal to issue bonds for the establishment of a municipal lighting plant in connection with the water system is under consideration. C. I. Jarnes is superintendent of the waterworks.

NEW BOSTON, ILL.—The Illinois Northern Utilities Company is considering the erection of a high-tension transmission line through New Boston, and also about 3 miles of rural line.

OSHKOSH, WIS.—The installation of an ornamental lighting system in Oshkosh is under consideration. For further information address F. A. Fuller, board of directors.

MINNEAPOLIS, MINN.—The City Council has ordered investigation of the feasibility of utilizing power to be developed at the government high dam in connection with a municipal electric plant. The survey will include data as to the amount of power available at the high dam, cost of installing turbines, cost of an auxiliary steam plant, and in what manner the power could be utilized for municipal purposes. F. W. Cappelen is city engineer.

CHILLICOTHE, MO. — The installation of additional street lamps in Chillicothe is under consideration by the Council.

LANAGAN, MO.—The erection of a transmission line from the municipal power plant to Anderson is under consideration by the City Council.

ST. LOUIS, MO.—Plans are to be carried out next year for resuming work of placing overhead wires underground in the residence district of the city at the rate of 4 miles a year.

REDFIELD, S. D. — The Spink Power Company is contemplating the erection of a transmission line from a generating plant at Aberdeen to connect with the lines of the company in Mellette. Proposal to issue bonds for construction of the line will be submitted to the voters in towns along the route. The cost of the entire project is estimated at $150,000.

BEATRICE, NEB. — Petition has been filed requesting the City Commissioners to call a special election to submit to the voters a proposal to issue $150,000 in bonds for an addition to the municipal electric lighting plant.

MADISON, NEB.—The construction of a new municipal electric light plant to cost about $70,000 is under consideration, estimates for which have been prepared by the Henninson Engineering Company, Omaha.

Southern States

LEXINGTON, N. C.—Extensions to the municipal electric light and water systems are contemplated, to cost about $50,000. Paul R. Raper is clerk.

WILMINGTON, N. C.—The Wilmington Cooperage Company, it is understood, is considering plans for rebuilding a portion of its power house recently destroyed by fire.

WILLISTON, S. C.—The Williston Ice Company is considering rebuilding its ice-manufacturing and refrigerating plant recently destroyed by fire.

ATLANTA, GA.—The substation of the Georgia Railway & Power Company at 146 Edgewood Avenue was recently destroyed by fire, causing a loss of about $10,000.

BIRMINGHAM, ALA.—The construction of a new plant, 140 ft. x 150 ft., to cost about $150,000, at the Birmingham Flour Mills is under consideration. Electric equipment, transmission and operating machinery and other mechanical apparatus will be purchased.

HARTSELLS, ALA. — Ernest Lynn of Hartsells contemplates the construction of a dam on Big Four Ranch in Morgan County to cost about $100,000.

JACKSON, MISS.—The construction of an ice-manufacturing and cold-storage plant to cost about $150,000 is under consideration by P. P. Vail and associates of Jackson.

MOUNTAIN HOME, ARK.—An organization is being formed by Dillen Underhill and associates for the purpose of operating an electric light and power plant in Mountain Home. The new company also proposes to erect an ice-manufacturing plant to be operated in connection with the power plant.

CORPUS CHRISTI, TEX.—The Corpus Christi Light & Power Company is considering extensions and improvements to its electric light and power plant including the installation of a new generating unit, to cost about $200,000.

SAN ANTONIO, TEX. — The sum of $100,000 has been appropriated for the construction of a power plant at the Southwest Texas Insane Asylum. J. G. Springer is suprintendent.

Pacific and Mountain States

CHEHALIS, WASH.—Preparations have been made by the North Coast Power Company for improvements to its power plant on Coal Creek in Chehalis, to cost about $17,500. The company plans to change its fuel feed system and install conveyors and equipment to burn "hog" fuel.

HOQUIAM, WASH. — Steps have been taken by the Commercial Club to secure a new street-lighting system in Hoquiam.

BLYTHE, CAL.—Plans are under way for rebuilding the local power house of the Southern Sierras Power Company recently destroyed by fire. The new building will be 40 ft. x 50 ft. L. W. Wise is local superintendent.

LOS ANGELES, CAL. — The Southern California Edison Company has had plans prepared for the construction of a two-story power house, 49 ft. x 55 ft., at 7125 Southwestern Avenue.

LOS ANGELES, CAL.—Plans are under consideration for the installation of electric lamps on Western Avenue and on Windsor Boulevard.

SAN FRANCISCO, CAL. — The Great Western Power Company has been authorized by the Railroad Commission to sell $1,000,000 in bonds, the proceeds to be used for completion of the Caribou plant on the Feather River and for the construction of a high-tension transmission line from the plant to Valona.

ELKHORN, MONT. — Permission has been granted to the Boston-Montana Milling & Power Company, a subsidiary of the Boston-Montana Corporation, by the Federal Power Commission to erect a high-tension transmission line to furnish electricity for the mills and reduction works of the company and in towns along the route of the Montana Southern Railway. The line will extend from the power plant of the Montana Power Company on the Big Hole River to the Elkhorn properties of the Boston-Montana Corporation. It is expected to have the line completed by Sept. 15.

FARMINGHAM, N. M.—The local electric light plant, flour mill and ice plant, it is reported, were recently damaged by fire.

Canada

WINNIPEG, MAN.—The Winnipeg Electric Railway Company has awarded general contract for the construction of a power plant at Point Du Bois, to the Northern Construction Company, Union Bank Building, Winnipeg. The cost of the plant is estimated at about $5,500,000.